Learning Text

Part 13

Best Practice - Potential Site Problems

Contents

Introduction

This learning text covers the topic of potential site problems and solutions, with particular emphasis on those that either become apparent on the building site or originate there. Thus it does not cover any production or operationally orientated issues that might arise at a mortar producing plant as these are covered in other learning texts in this series. The learning text also incorporates a glossary of terms and self-assessment questions and answers.

Although mortar is an easy material to specify and use, with numerous examples of masonry structures that have stood for many centuries attesting to its excellence, a variety of site problems occasionally arise, the most common of which are discussed in this learning text.

It should be noted however that problems are rarely experienced with factory produced mortar where batching is well controlled and monitored and production is covered by factory production control procedures. Most material related issues arise at the construction site. They may occur either where the mortar is improperly gauged and mixed on site, or where factory produced mortar is subjected to unauthorised additions or procedures. Typically:

- The addition of inappropriate admixtures or other materials
- Use of excess water
- Re-mixing when the set has started
- Incorrect storage and protection

These practices have in common a lack of control, use of incorrect equipment and procedures and/or lack of properly trained staff.

In general, mortar problems on site may be classified as follows:

- Those that are caused by material issues, as listed above
- Those caused by poor workmanship
- Those that occur as a result of prevailing weather conditions, in general extremes of sun, rain or wind at the time of laying.
- Weathering issues that occur later in the life of the masonry

It should always be borne in mind that some reported problems, as for example those resulting from the effect of weathering on mortar that is not properly covered or protected are not caused by any deficiency in the mortar manufacture, but rather by inadequacies in site practice, often exacerbated by local weather conditions, that occur at a later time.

Incorrect Mix Proportions

The vast majority of mortar with incorrect mix proportions has insufficient binder, although it is possible in rare situations to find examples where excessive binder has been used. In the case where constituents are mixed on the building site, poor mixing, logistical and/or related circumstances often lead to a situation where mortar with inadequate amounts of binder are produced.

Although virtually all Standards, Codes and other documents refer to the need to measure binder, preferably by weight but if not, by volume, in the vast majority of cases site-mixed mortar this is not measured. The binder is merely added by means of a shovel, with no attempt at measurement, except perhaps for counting the number of shovelfuls' used. Even if this counting method is adopted, it is very inaccurate as a full shovel of binder can be much less than one of sand, as well as being greatly variable in amount. Problems arising in these situations may be compounded in cases where the bagged cement store is some distance from the site mixer location.

It is strongly recommended that all mortars are properly gauged by measurement, either by volume or preferably weight, to alleviate these problems. On all but the largest of sites it is generally accepted that the installation on site of weigh batching equipment is unlikely to be cost effective, and on the majority of sites if it is considered essential to use weigh batching then factory produced mortars will be used. It is however possible to adopt correct procedures on site for volume batching. These can range in complexity from assigning suitable containers, perhaps no more sophisticated than buckets, with one being retained for the sand and the other for the cement and/or lime, to the use of purpose constructed gauge boxes. In this context it should be noted that specially made gauge boxes are often found to be cumbersome, heavy when filled and hard to handle, so that the use of buckets is often a practicable alternative, if not the best option.

When there is a suggestion of low cement/binder content, it is sometimes proposed that the work be taken down and re-erected with the correct mortar. This is very rarely justified or indeed worthwhile, particularly as it is often based on the slightest of anecdotal evidence, usually involving scraping the surface of the joint with a nail or some other convenient tool and on the basis of the impression gained, suggesting that the mortar is too weak, and must be potentially lacking in durability and/or strength. This assumption is obviously not made on any valid grounds. Occasionally it may be necessary to rake out the affected areas and repoint, but even that is usually unnecessary and it will often be found that the mortar used is sufficiently strong and durable for the particular application and that no remedial work at all is required.

If the mortar is reported to be weak and this is based on the results of chemical analysis then care should be taken to ensure that this has been carried out strictly in accordance with the relevant British Standard, which is BS 4551, Methods of test for mortar. It is not uncommon for results to be presented that are either not carried out in accordance with the requirements or are not interpreted in the correct manner that is described in detail in the standard. A deviation in either area means that the reported mix proportions will be meaningless.

Where it is suggested that the mix proportions are in error and remedial measures are proposed, the criteria used to address the problem should encompass two issues, the structural considerations and the likely durability considerations. To consider the design and structural issues it is necessary to consider the wall design.

Walls may be divided into two types. The first are known as load bearing, which support loads from floors and roofs in addition to their own weight. They may also resist lateral (side) pressure from wind and sometimes from stored materials or objects within the building. The second are non-load bearing. These carry no floor or roof loads.

External walls are required to provide adequate properties in respect of:

- Strength and stability
- Weather resistance
- Fire resistance
- Thermal insulation
- Sound insulation.

Internal walls may be required to possess some but not all of the above properties.

Where a solid external masonry wall is constructed it is very difficult to prevent the ingress of moisture, and it may be helpful in this context to ensure that the mortar and the masonry units have similar absorptive properties. Any water striking the structure will then enter the pores of the units and mortar and be held in the body of the wall. Successful construction using a solid wall presupposes adequate absorptive capacity of the wall to ensure that any water penetration proceeds at a relatively slow pace. The requirement for a thick and generally therefore heavy wall, which is essential in most cases for the success of this method, is one of the reasons that has brought about the more general use of cavity wall construction.

External rendering is sometimes adopted as a means of reducing water penetration through a solid wall, where it can act either as a relatively impervious or an absorbent skin.

Cavity wall construction overcomes many of the problems inherent in both absorbent and impermeable solid wall construction. A cavity wall is built in two leaves or skins so that the outer surface of the wall is isolated from the inner surface by a continuous gap. This gap provides better resistance to rain penetration and the potential for a much greater degree of thermal insulation compared to a solid wall of the same thickness and material. In cavity wall construction the two leaves of the wall are connected together by wall ties, which means that they stiffen each other and act as one under load.

It will often be found that there is no structural load-bearing requirement made of the brickwork. This is certainly the situation in virtually all low rise domestic housing, where it is a decorative skin, required to resist only wind loads, with the loads due to the roof structure being taken by the inner leaf, which is usually constructed of blockwork, which will therefore be required to be adequate. Where this is the case, and the potential durability is the key issue, so long as there are sufficient wall ties and adequate strength to resist wind loads both by load transfer to the inner leaf and also inherently in respect of any residual loads, the wall should be satisfactory.

The Use of Unauthorised Admixtures

It is relatively commonplace to find that mortars have been modified on the building site to increase the air content in order to achieve better working properties. Site-made mortars are frequently adulterated by the use of unauthorised air entraining admixtures, commonly taking the form of domestic detergents or washing up liquids. These are sometimes added to premixed, (sometimes known as readymixed) lime:sand mortars on site, even though these have the correct amount of such admixtures added in the factory.

These additions are made with a view to entraining more air. However this may result unwittingly as a result of adding more gauging water to a mortar that has begun to dry on the spot board and overlooking the fact that the water butt or other container has had admixture added to it, as is sometimes recommended, so that the admixture is well dispersed.

Because the use of unauthorised additions entrain air, they produce a mortar of enhanced fresh properties and ease of use but the amount of air entrained is uncertain and may well be excessive, leading to reduced strength, particular in bond which is most undesirable.

Masonry cements, which are specially formulated for site mixing already include an air entraining admixture, so it is again unnecessary to add any more in the form of detergent. However, many of the proprietary bagged cements now on sale in builders' merchants already contain some air-entraining admixture, which needs to be taken account of before any further admixture additions are contemplated.

The other type of unauthorised admixture that is occasionally added to mortars on site is the so called anti freeze agent. This is generally based on calcium chloride; its use is universally deprecated and it should never be used. Calcium chloride is deliquescent, attracting moisture and this is always undesirable in masonry mortars. Calcium chloride also promotes corrosion of embedded steel and although this is required to be stainless or galvanised, for use embedded in masonry, it is nevertheless advisable to avoid any potential issues, particularly as some galvanised components that are used are cropped from continuous lengths of coated bar or strip and rely on the smearing action of the cutter to passivate the cut end.

Finally, with respect to calcium chloride, the inclusion of the material does not even bring the protection against early life freezing and thawing problems that it may assist with in eg mass concrete. Although it is not recommended in that application, its use can certainly result in a more rapid set and an earlier evolution of heat of hydration. If the concrete member concerned is large and the cement content adequate the resulting heat can raise the temperature of the concrete, potentially to above freezing point if it is at a marginal temperature, thus potentially avoiding problems. It is again emphasised that the use in this situation is not recommended but it can be seen that its inclusion in mortar will not even bring about this effect because if the mortar temperature is at or about freezing point then the bricks or blocks will also be at that temperature, as will the ambient air. This means that any attempt to raise the temperature of the mortar joint, surrounded, as it will be by materials at low temperature that will conduct the heat away immediately, is clearly unsustainable.

Working Properties

In contrast to many heavy bulk building materials, all mortar is effectively subjected to a close appraisal in that it is picked up and applied one trowel full at a time, and judged as it is spread to form the bed joint, and then later when the joint is finished.

This, together with the fact that masonry is almost always costed and paid for on the basis of the number of bricks that are laid, or the number of square metres produced, that is payment by results or piece work, (see glossary), means that it is of key importance to maximise the working properties. Any failure to optimise them will have the potential to attract detrimental comment from the masons. Care must be taken however to ensure that the requirements of the masons do not override the overall technical requirements of the mortar, in particular with respect to the ultimate strength, both compressive, tensile and bond, as well as the durability and other necessary hardened properties.

There is a tendency for operatives to impose their requirements with respect to their preference for the use of fine sands and mortars that are highly air entrained. Whilst these are useful in achieving their aims of ease and speed of laying they may not always produce the desired hardened properties and it is therefore recommended that such requests be treated with caution.

Appearance

Aesthetic Considerations

Whilst structural aesthetic - considerations, and to a lesser extent, durability problems, are obvious and unacceptable, the aesthetics are also important and can be seen as an emotive issue with many clients. In particular, where coloured mortars have been specified, or even where natural but factory produced mortars are specified, the clients perception of the colour uniformity may exceed that which is realistically achievable without incurring substantial cost. As an example, even with factory produced mortar the possibility of a slight change in the sand colour cannot be precluded.

All constituent materials can vary in colour, which may alter the colour of the final mortar to an extent that the client may deem unacceptable. This gives rise to a need to consider the amount of colour difference that is acceptable, and how the needs of a particularly stringent client may be met. The only way in which to minimise colour variation would be to stock sufficient constituent materials for the whole of a particular mortar contract, or if this does not prove practicable produce the work in unpointed form to point in at a later date using the same consignment of mortar. This suggestion would almost always be seen as clearly impracticable though and a reasonable, practicable and cost effective solution would be less demanding than this extreme example.

Where constituent raw materials are not purchased in bulk from a materials producer, there is a possibility that the original source may change. As an example, bagged cement purchases may not always continue to derive from the same source for the duration of a construction contract, even if they are collected from the same outlet.

One further pre-requisite in the area of aesthetics is the requirement to ensure that the client understands the necessity to view masonry at an appropriate distance, rather than in close-up as eg from a metre or less. Instead, external masonry should be viewed from a minimum distance of several metres, at which distance the scale and proportion are taken into account and the possibility of a disproportionate influence being exerted by a close up view of one component of the masonry façade is avoided.

Whilst so far as is known, no relevant Standards or Codes prescribe appropriate distances for viewing, it could be suggested that perhaps for stairwells and other building interiors that can be seen at close range 1m might be a suitable minimum distance, with perhaps 3m for general external surfaces and 6m for external elevations higher than the second floor level. It is emphasised that these figures are only suggested as being of some assistance, and are not intended to assume any contractual significance. Of key importance is the need to view a wall or façade as a whole, rather than focussing on selective areas.

It should also be recognised that all external elements in a building façade undergo substantial changes due to weathering and any judgement as to the effect or magnitude of a colour difference may well be premature if the initial weathering process is incomplete.

Notwithstanding the above issues, assuming that the structure is viewed from a reasonable distance, after the initial weathering has taken place there may still be differences that are judged to be unacceptable and these are considered in detail in the following sections.

Inconsistent Colour

It should first be ensured that the work is being viewed from an acceptable distance, as discussed previously, and that the judging criteria are not over critical, having regard to the impossibility of achieving absolute and total colour consistency on a building site, in a structure designed to be viewed from some distance.

Consideration should be given to the relative ages of any elements that are said to differ in colour. Judgements should only be made after the material has completed its initial drying. Any premature colour comparisons will clearly be invalid but are nevertheless not infrequently made.

It is often recommended in the context of comparing workmanship and/or unit variability that trial panels be erected as a preliminary to full scale construction, with their standard of appearance being taken as acceptable as a yard stick for the overall project. It is recommended that consideration be given to adopting this practice.

Assuming that the age at which comparison is made is valid it then needs to be accepted that mortars laid at different times, in different weather conditions, will inevitably dry to at least slightly different colours, perhaps with a pronounced difference. Only after this has been accepted should any discussions concerning possible further measures take place

White Staining

White staining, known as efflorescence or bloom, is deemed by some clients to be totally unacceptable and the walling materials and design should take account of this issue.

Good workmanship is also a key factor and site practice should ensure that newly erected masonry should be covered at the end of each working day or when rained off.

Failure to cover newly erected masonry will clearly render it vulnerable to saturation in the event of rain or snow, with the possibility of durability problems but also of disfiguring staining occurring.

Hydrated Portland cement remains very sparingly soluble, and saturation results in the potential for leaching of a calcareous solution from hardened mortar, primarily in the form of dissolved calcium hydroxide. When water from this solution evaporates, material may be deposited on the surface of the joint or unit, generally in the form of calcium carbonate as a result of the reaction with atmospheric carbon dioxide, or with dissolved species in rainwater.

Whilst white stains of this type are sometimes known as efflorescence, it aids clarity if they are termed bloom and the term efflorescence is reserved for other soluble species, as discussed further under that heading.

Bloom

Failure to properly protect the new work often results in a typical horizontal line of white staining, formed by this process of leaching of solution from the mortar by the passage of water. The water thus dissolves the soluble compounds and may well then deposit them again as it evaporates and dries out, to leave a more concentrated solution or a precipitate on the surface. These may then go on to react with the carbon dioxide present in the atmosphere to produce a white stain.

Bloom is fortunately acid soluble, and in time may weather away. If remedial works are seen as being essential, the mortar joint may sometimes be treated with a dilute acid cleaner, but this should only be carried out strictly in accordance with the instructions provided by the manufacturer of the cleaner, taking care to use full personal protective equipment appropriate to the task and to comply fully with all health and safety requirements.

Efflorescence

For clarity, the term efflorescence should be reserved for materials that deposit on the surface of the joint but are not composed of calcium carbonate. Efflorescent salts may derive from the bricks or blocks, from the soil or other adjacent environmental source such as run off water, or less usually from the mortar. It is now much less common to find that bricks or blocks contain efflorescent salts as these are now either not present in the raw materials or are removed or rendered harmless during the manufacturing process.

In rare cases, bricks or blocks may become contaminated by being stocked on ground, which contains efflorescent salts. These ground conditions may also lead to contaminated water run-off carrying salts to the masonry although any problems relating to this cause should be minor in aesthetic terms as they should only occur below the damp proof course. Occasionally contaminated soil is placed against a masonry structure such that it covers the damp proof course (dpc) and in these situations this must clearly be removed.

It is sometimes suggested that the mortar sand may contain efflorescent salts but this is unlikely to be the case in sufficient amounts to cause long-term visible efflorescence with a washed sand. Even dry screened sands can almost certainly be discounted in this respect.

The first step to take in appraising a case of efflorescence is to consider what mechanisms caused the material to dissolve and be transported to the surface of the masonry. These will always involve the passage of water, as efflorescence is always transported into place as a solution of salts dissolved in water. Therefore the first issue to consider is the source of this water, without which further efflorescence will not occur. An excess of water is invariably a prime cause of efflorescence and removing this source, which means that the salts responsible for the problem will remain harmlessly in their place of origin, will stop a continuing occurrence of the problem.

The excess of water is frequently present as a result of a building defect, often one that has gone unnoticed for a period of time. In cases where the masonry materials do contain efflorescent salts it is known that these may remain in the fabric for many years, often quite innocuously, but can then be “activated” if for example a building defect or an overzealous cleaning of the masonry by water washing takes place.

Defective overflows, gutters and similar can cause efflorescence in work that has been constructed for many years, and has shown no previous signs of staining. Copings that become detached, or even those that develop cracks and gaps where the bond between adjacent units has failed are also common causes. In all of these cases further deposits will cease when the cause of the water ingress is stopped by remedying these defects.

Remedial measures in the event that efflorescence occurs should be initiated only if great care is taken. Acid based masonry cleaners are sometimes used and these will not be effective, indeed they may exacerbate the problem.

Washing with water should not be used as this will only dissolve the material and will tend to re-precipitate it elsewhere in the structure as the water runs down the face of the masonry. The use of water may well also dissolve further salts that may have been present quite harmlessly in the masonry, in solid as opposed to dissolved form, since construction and would never have become visible if the work had not been saturated.

Probably the best remedial measure consists merely of a light brushing, carried out with a soft brush, but even this may compound the problem with some textured surfaces, particularly if the brushing is too vigorous, by transferring the material deeper into the surface texture, making further removal even more difficult.

The best solution is often just to remove all obvious routes for water ingress and allow the natural weathering process to remove the efflorescence gradually. In addition, the client should be made aware that in many situations a certain amount of efflorescence is normal and does not detract from the appearance of the masonry. Indeed, in some situations it may add to the attraction, particularly where there is adjacent historic brickwork and stock bricks have been used, where it may add to the authenticity of the overall appearance.

Laitance

As a mortar joint is worked, and finished with the trowel, bucket handle or other tool, the moisture and the fines may tend to form on the joint surface. On drying, the colour at the surface thus formed may well be lighter than that within the body of the mortar, or indeed than that in adjacent areas. This surface layer, which is generally but not always of a lighter colour, is called laitance.

It may be the case that different parts of a masonry structure exhibit differing amounts of laitance and this, which will then tend to give rise to different surface colours, may attract critical comment. The phenomenon is clearly closely related to workmanship, as it is the joint finishing process that is carried out by the operative that causes the surface layer to arise. Care in joint finishing, and the adoption of uniform methods and standards throughout one structure, are therefore required in order to minimise the problem.

There are other influences on the amount of laitance and the potential variability that it will cause and these relate to the type of joint and the type of unit that is being laid as well as to the workmanship in isolation. Joints that involve a lot of finishing, smoothing or similar will inevitably tend to be more problematic in this respect than for example a simple struck joint. Indeed, the well-known bucket handle joint is particularly prone to laitance effects. Bricks or blocks that are of low absorption, such as dense units or those that have become saturated on site also exacerbate the problem.

In order to minimise issues arising from laitance then, consideration should be given to unifying pointing techniques, to careful specification of joint finish and to providing appropriate protection to units that are stored on site prior to incorporation into the works.

Colour Loss

It is sometimes suggested that the pigment in a coloured mortar has faded but this is rarely, if ever the case, although on visual examination the mortar may well appear to have lost colour.

This is frequently because the true, underlying colour has become obscured by a surface layer of bloom or efflorescence. If this is the case, then reference should be made to the earlier parts of this text where those phenomena are discussed.

The colour can become obscured in the very early life of the masonry as a result of laitance, and again reference should be made to the appropriate part of this text.

The mortar colour may also change, or appear to be lost or faded, as a result of surface erosion. All building materials have the propensity to become eroded to a greater or lesser extent as a result of natural weathering processes. Clearly, in the case of extremely durable materials as for example stainless steel, this process will be slow and often virtually indiscernible. In contrast, very soft stone may weather at a relatively rapid rate. Surface erosion will result in preferential loss of the finer mix components, which include the pigment, thus leading to a colour change.

This natural weathering is a function of exposure to wind, rain and contaminated atmospheres and will proceed in all structures. With cementitious materials, as for example mortar or concrete, the amount of cement or binder is also important. Weak mixes with low binder content will tend to suffer more from surface erosion than mixes with relatively high cement contents. Detailing is also important, as lack of good provision in this area will mean that the mortar is more exposed to the action of the weathering.

Chemical and Physical Attack

Freeze-Thaw Cycles and Frost Attack

If masonry is saturated then cycles of freezing and thawing may cause degradation and ultimately failure.

Again, detailing should aim to avoid this problem with proper provision of damp-proof courses and copings to avoid long-term saturation of the masonry.

However, much masonry will inevitably become wet, sometimes saturated and potentially frozen, and in these situations the use of air entrainment is extremely beneficial.

Most standards specify the use of air entrained mortar where durability is an issue and, as considered later within the section on sulfation, this will provide enhanced durability to both sulfates and freeze-thaw cycles. Durability itself is a difficult term to define, and at the time of writing there is no accepted test method for mortar durability although one is currently under development. Again as with considerations of sulfation, the provision of a mortar with sufficient binder and appropriate sand grading for the particular application is of key importance in this area.

The use of air entrainment is always advised where mortar has the potential to become saturated whilst exposed to freezing temperatures, which effectively covers all external masonry in the vast majority of the UK, some exceptions being in parts of the extreme South and West. It is sometimes suggested that chloride free accelerators/ “anti freeze” agents be added to the mortar, with these purported to provide a measure of protection against problems caused by freezing in the early life of the mortar, but as discussed earlier in the context of unauthorised admixture usage, these will provide no benefit. Additionally, the use of accelerating admixtures may cause practical problems to the masons, as the working life of the mortar will be reduced.

The use of good quality materials and a mix design that is appropriate for the particular exposure conditions should ensure excellent durability and good resistance to both sulfation and the effects of freezing and thawing, without recourse to unnecessary and indeed potentially harmful additions to the mortar.

Sulfate Attack

The cement in hardened mortars may become attacked by certain aggressive and reactive chemicals if the work becomes saturated so that these are able to form a solution and then react with the cement compounds. One component present in Portland cements, the tricalcium aluminate, can react with soluble sulfates to form tricalcium sulfoaluminate or, less usually, with the calcium silicate hydrates to form a mineral called thaumasite, which then gives rise to a special type of sulfation known as the thaumasite form of sulfate attack.

The most common form of sulfate attack in mortars however is the long understood sulfoaluminate form. Because the reaction involved is expansive, with the reaction compound ettringite having a much larger volume than the reactants, sulfation can cause spalling, degradation and ultimately failure of the mortar.

It is important therefore to avoid excessive saturation where reactive sulfates may be present or to use binder that does not react or that reacts to a minimal degree only. It is also important to note that the general quality of the mortar is of great importance in assessing its likely susceptibility to sulfation. Mortar mixes with sufficient binder content, appropriate sand grading and cleanliness and with the inclusion of air entrainment, are generally unlikely to be badly affected, particularly if they do not become saturated in service.

Although in theory sulfates may result from a number of diverse sources, in reality they are probably only present in sufficient amounts to cause failure in either the masonry units or the ground, and the number of masonry units produced with excessive sulfates is small and declining.

Assuming that the atmosphere is not contaminated, the problem therefore generally becomes one of ensuring that any sulfates present in the soil are not permitted to come into contact with the mortar, which means the correct detailing of damp-proof courses (dpc's) and related details. Below dpc level it may be necessary to use a mortar that is richer in binder but it is unlikely that a mix as rich as a designation (i), (see glossary of terms), will be required, generally a designation (ii) will suffice, although the amount of sulfate in the soil and the mobility of the sulfate solution is also a key consideration. If there were no moisture movement and the ground was dry sulfates in the ground would not matter. The important factor is that the ground water is generally mobile rather than static.

For those relatively rare situations where sulfate may be present in the units or in the atmosphere, protection against saturation in the form of properly designed copings and overhangs will assist and should be afforded at the design stage.

There are indications that the presence of entrained air will act as some degree of protection against sulfate attack and increasing evidence that the use of ground granulated blastfurnace slag and fly ash replacements, as discussed in the MIA learning text on cementitious materials, is beneficial.

The thaumasite form of sulfate attack has also been found in mortars but has usually appeared to arise only when gypsum containing components are mistakenly added to the mortar, although the presence of both types of attack in the same situation cannot be precluded.

Conclusions

This learning text discusses the majority of the potential problems that may occur if correct procedures are not adopted. However, it is emphasised that masonry constructed of bricks, blocks or stone together with factory produced mortar is well tried and successful.

Glossary of Terms

Binder	Material used for the purpose of holding solid particles together in a coherent mass.
Bucket handle joint	Joints formed by rubbing a convex jointing iron over them.
Calcareous	Material containing significant amounts of calcium carbonate.
Cavity wall	Two parallel single-leaf walls, usually spaced at least 50mm apart, and effectively tied together with wall ties, the space between being left as a continuous cavity or filled with a non-load bearing material.
Coping	Construction that protects the top of a wall, balustrade or parapet and sheds rainwater clear of the surfaces beneath.
Designation (mortar designation)	A numeric value, which indicates the composition of the mortar from which certain physical properties may be inferred.
Damp proof course (DPC)	Device, usually comprising a layer or strip of material, placed within a wall chimney or similar construction to prevent passage of moisture.
Durability	The resistance of a mortar to adverse chemical, mechanical and climatic conditions, which comprises its effective life.
Efflorescence	Crystallisation of salts on the surface of a mortar.
Gauge boxes	Containers used to measure the volume of constituent materials of a mortar mix
Hydraulic binder	Binder that sets and hardens by chemical interaction with water and is capable of doing so under water.
Inner leaf	The inner wall of a cavity wall construction, the outer wall is called the outer leaf.
Laitance	A layer of scum, which may form on the face of a mortar.

Leaching	The removal of salts from a material due to the passage of water through it.
Load bearing	Wall primarily designed to carry an imposed vertical load in addition to its own weight.
Mason	Individuals who builds or works with stone or brick.
Masonry	Assemblage of masonry units, either laid in-situ or constructed in prefabricated panels, in which the masonry units are bonded and solidly put together with mortar or grout.
Mortar joint.	The mortar between two bricks or blocks that holds them apart, as opposed to a movement joint, construction joint or similar as with concrete.
Passivate	Protect against chemical reaction, as for example oxidation or corrosion.
Piece work	A method of wage payment where the persons pay is directly related to the number of units produced or the quantity of work completed.
Pointing	The final process of finishing a mortar joint to give a finished appearance. BS 6100 states Filling a partly raked back mortar joint to provide a finish.
Reference panel	Panel of masonry erected and retained on a building site, used to establish the visual acceptability of materials and workmanship to be maintained during the construction work.
Repoint	To replace the pointing.
Sample panel	Panel of masonry erected on a building site as a means of comparing materials with an established reference panel.
Spot board	Board up to 1 m square, on which fresh mortar or plaster is mixed or held before placing.
Struck joint	Joint formed with a trowel edge.
Wall ties	A component built into the two leaves of a cavity wall to link them. They are usually made of non-ferrous metal or galvanised steel.

Self-Assessment Questions

1	What is a dpc?
2	What is laitance?
3	State two ways of obtaining the correct mix proportions on site
4	Name one type of unauthorised admixture.
5	What are the two forms of sulfate attack?
6	What is the best way of removing efflorescence?
7	What is the function of a wall tie?
8	What is the suggested minimum masonry viewing distance for internal stairwells?
9	What is a bed joint?
10	What is lime bloom?

Answers to Self-Assessment Questions

1	A damp proof course is generally composed of a strip of material inserted in a construction to prevent the passage of water.
2	A layer of scum, which may form on the face of a mortar.
3	By accurate weight or volume batching on site or by the use of factory produced mortars
4	Washing up detergents Anti freeze
5	Thaumasite Sulfoaluminate
6	A light brushing with a soft brush.
7	A component that joins together the two leaves of a cavity wall A wall tie is a metal component used to connect the two leaves of a cavity wall so that they function as a single unit
8	1 metre
9	Horizontal joint in masonry
10	Film of calcium carbonate formed by carbonation of calcium hydroxide leached to the surface of masonry.