

## CHAPTER SIX

# Specification of Brickwork, Masonry and Waterproofing

---

THIS chapter deals with the drafting of specification clauses covering brickwork, masonry and waterproofing work. It is desirable that a logical sequence of items should be adopted for each section of work, preferably beginning with materials clauses and following with particulars of workmanship. It will be appreciated that the detailed requirements vary from job to job and that the typical clauses produced aim at giving a guide as to their possible form and content.

There are a number of relevant British Standards and Codes of Practice which can be usefully employed and reference is made to most of them in the typical specification clauses which follow. The principal items to be covered in specification clauses for each of the three works sections covered by this chapter are now listed.

### BRICKWORK

- (1) Bricks
- (2) Mortars
- (3) Bricklaying generally
- (4) Damp-proof courses
- (5) Faced brickwork and pointing
- (6) Special features or classes of work

### MASONRY

- (1) Dressed stonework (ashlar)
- (2) Various forms of rubble walling (squared, random, dry rubble walling, etc.)

## SPECIFICATION OF BRICKWORK, MASONRY, WATERPROOFING

- (3) Special stonework (copings, quoins, arch stones, etc.)
- (4) Dowels, cramps, etc.
- (5) Cast stonework

### WATERPROOFING

The nature and content of the specification clauses in this section will be largely determined by the constructional details of the particular job. Asphalt is widely used in good-class work and various bituminous applications are also available, in addition to polythene sheeting, there is a wide range of proprietary integral waterproofer and waterproofing paints. In each case, the specification clauses can normally be subdivided into two categories: materials and workmanship. The workmanship clauses will often describe the method of performing the work as well as the quality required.

#### TYPICAL SPECIFICATION CLAUSES

#### EXPLANATORY NOTES

### BRICKWORK

#### Bricks generally

All bricks shall conform to the requirements of B.S. 3921 and in addition they shall be hard, sound, square, well burnt, uniform in texture, regular in shape, with true square arrises, and even in size. Care is to be taken in unloading, stacking and handling and no chipped or damaged bricks shall be used.

All bricks shall be equal to samples submitted to and approved by the Engineer before any brickwork is commenced. Adequate stocks of bricks shall be maintained on the site to ensure continuity of working.

*Common bricks.* The common bricks shall be 65 mm (2½ in.) commons supplied by Messrs X or other equal and approved.

All bricks, irrespective of their type or function, must conform to certain basic minimum requirements and be equal in all respects to submitted and approved samples.

The common bricks are often obtained from a local brickworks when one is available.

#### TYPICAL SPECIFICATION CLAUSES

*Engineering bricks.* Engineering bricks shall conform to the requirements for class B engineering bricks in B.S. 3921.

*Facing bricks.* Facing bricks are to be Antique dark brown facing bricks obtained from Messrs Y at a prime cost of £18.5 per thousand bricks delivered to the site.

#### Mortar

Mortar for engineering brickwork shall consist of one part of ordinary Portland cement, as previously specified, to three parts of sand. The sand shall comply with B.S. 1200, Table 1, shall be approved by the Engineer before use and shall be adequately protected from contamination.

Sand shall withstand satisfactorily the following test. A sample of sand shall be mixed with water (in the proportions of one part sand to two parts water) for one minute in a cylindrical glass jar with a flat base. It shall then be set aside for two hours for the contents to settle and at the end of this period, the top layer of fine materials shall not exceed 5 per cent of the volume of the solid matter in

#### EXPLANATORY NOTES

This British Standard details two classes of engineering brick with minimum average compressive strengths of 69 MN/m<sup>2</sup> (10,000 lbf/in.<sup>2</sup>) for class A bricks and 48.3 MN/m<sup>2</sup> (7000 lbf/in.<sup>2</sup>) for class B bricks.

Note: These strengths will probably be rounded off to 70 and 50 MN/m<sup>2</sup> respectively and might be expressed in N/mm.<sup>2</sup>

In most cases the facing bricks will have been selected to ensure that the desired colour and texture of brick is obtained. The inclusion of a prime cost prevents each of the contractors tendering having to obtain quotations.

Different types and proportions of mortars may be specified for different classes of work. Strong cement mortars are needed for heavy load-bearing and damp-resistant structures, gauged mortar for general work and possibly lime mortar for work requiring maximum flexibility, as in tall chimney shafts.

All the materials used should comply with the relevant British Standards and adequate safeguards should be introduced to cover gauging, mixing, sampling and use of mortar.

#### TYPICAL SPECIFICATION CLAUSES

#### EXPLANATORY NOTES

the jar. The water remaining from the test shall show no evidence of sewage, organic or chemical contamination.

Different sands shall be stored separately and sands for pointing shall be obtained in sufficient quantity at one time to enable material of the approved colour to be used for the whole of the work. Sand for pointing mortar and fine joint work shall pass a 1.5 mm ( $\frac{1}{16}$  in.) square mesh sieve.

Mortar for common and faced brickwork shall consist of gauged mortar mixed in the proportions of one part of ordinary Portland cement, one part of non-hydraulic or semi-hydraulic lime and six parts of sand. The lime shall comply with B.S. 890, class B, and shall be stored in a similar manner to that described for cement.

All materials for mortar are to be accurately measured in proper gauge boxes and shall be mixed on a suitable stone or wooden banker or in an approved mixer with only sufficient water added to produce a workable mix. All gauge boxes, bankers and mixers shall be kept clean.

The Contractor shall permit samples of mortar to be taken from time to time for testing and re-tempering of mortar will not be permitted. All mortar shall be mixed in quantities sufficient for only 30 minutes work.

#### **Bricklaying**

All brickwork shall be built to the dimensions, thicknesses and heights and in the positions shown on the Drawings or as directed by the Engineer and in conformity with CP 121.101. Clean off

It is usual to specify that all brickwork shall be laid to the dimensions and in the positions shown on the Drawings. It is also advisable to

#### TYPICAL SPECIFICATION CLAUSES

#### EXPLANATORY NOTES

and prepare all concrete and other surfaces on which bricks are to be laid.

All brickwork shall be built uniform, true and level, with all perpends vertical and in line, and shall rise 300 mm (12 in.) in every four courses. No brickwork shall rise more than 1.25 m (4 ft) above adjoining work during bricklaying and the work in rising shall be properly toothed and racked back.

All bricks shall be wetted sufficiently prior to laying to avoid excessive suction. All bed and vertical joints shall be filled solid with mortar as the bricks are laid. Bricks shall be laid with frogs uppermost and shall be wetted during hot weather.

Prices for brickwork shall include the cost of all necessary scaffolding.

prescribe general rules governing bricklaying to ensure thoroughly sound and stable brickwork. Note the reference to the relevant Code of Practice.

#### **Bonding of brickwork**

Walls exceeding 115 mm ( $4\frac{1}{2}$  in.) in thickness shall be built in English bond unless otherwise directed by the Engineer. Half-brick walls shall be constructed in stretcher bond. Hollow walls shall be constructed of two half-brick skins separated by a 50 mm (2 in.) cavity and tied with three 150 mm (6 in.) galvanised strip-type fish-tailed ties to B.S. 1243 per square metre (sq. yd) in staggered formation. All ties shall be kept clear of mortar droppings. The use of snap headers shall not be permitted and bats shall be allowed only as closures.

It is necessary to specify the bonds to be used in the construction of the brickwork and to state the number and type of wall ties in hollow walls.

#### **Labours to brickwork**

The Contractor shall build in or cut and pin the ends of joists, lintels, steps,

The type of labours involved will vary from job to

#### TYPICAL SPECIFICATION CLAUSES

corbels, etc., and shall build in all frames and bed and point in cement mortar.

The Contractor shall perform all necessary rough and fair cutting and shall form all necessary chases and reveals.

The Contractor shall rake out joints of brickwork for the insertion of metal flashings, wedge the flashings and afterwards repoint the joints in cement mortar.

#### **Bricklaying in frosty weather**

When frost is likely to occur brickwork shall be properly protected and covered with sacking, tarpaulins or other suitable material in the manner recommended in CP 121.101. Any brickwork which has been affected by frost shall be pulled down and rebuilt at the Contractor's expense.

Protection shall also be provided against heavy rain or other severe weather conditions.

#### **Damp-proof courses**

(a) *Engineering bricks.* The Contractor shall lay over the full thickness of all walls in the positions indicated on the Drawings, a damp-proof course of two courses of class B engineering bricks to B.S. 3921 bedded and pointed in cement mortar (1:3).

(b) *Bitumen felt.* The Contractor shall lay over the full thickness of all walls in the positions indicated on the Drawings a damp-proof course of a single layer of bitumen felt, incorporating a hessian

#### EXPLANATORY NOTES

job and the specification writer must examine the drawings carefully, in order to pick up all the labours needed and describe them in the specification.

The Contractor is invariably required to protect new brickwork adequately against frost and other severe weather conditions. Responsibility for the replacement of work damaged by the lack of such protective measures rests with the Contractor.

Various damp-proof course materials are available, from engineering bricks and slates to bitumen felt and sheet metals. Two of the most popular materials have been taken to illustrate the approach usually adopted. Note the reference to relevant British Standards wherever possible and the need to state the extent of laps with materials supplied in rolls.

#### TYPICAL SPECIFICATION CLAUSES

#### EXPLANATORY NOTES

base and a layer of lead in accordance with B.S. 743, type 5 D. Joints in the bitumen felt shall be kept to a minimum and the damp-proof course shall be lapped 225 mm (9 in.) at joints. The bitumen felt shall be bedded and pointed in cement mortar (1:3).

#### **Faced brickwork**

Facing bricks of the type specified shall be laid in the positions indicated on the Drawings and all facing brickwork shall be well bonded to the backing bricks. No facing brickwork shall at any time be more than 600 mm (2 ft) above the backing brickwork.

All facing brickwork shall be pointed with a rubbed joint as the work proceeds and internal faces of brickwork shall be pointed with a neat flush joint to give a fair face.

Faced work shall be kept clean at all times and scaffold boards adjoining brick faces shall be turned back at nights or during heavy rain. All faced brickwork shall be cleaned down as necessary on completion to give an even-coloured surface free of mortar droppings or staining of any kind. The Contractor shall carefully fill all putlog holes with bricks similar to the surrounding brickwork, point up as required and generally make good.

#### **Reinforced brickwork**

Reinforced brickwork shall be provided with strips of No. 20 gauge expanded metal in each bed joint as shown on the Drawings. The expanded metal

Faced brickwork is normally provided to the external wall faces of buildings to enhance their appearance. Numerous types of facing bricks and methods of pointing are available. Pointing can be performed as the bricklaying proceeds or be left until the brickwork is complete. The joints are then raked out and pointed to secure a uniform treatment throughout. Brick joints can be finished flush, struck or weathered; have a shallow, rounded or rectangular recess; or take a more complex form.

Brickwork is sometimes reinforced to increase its resistance to tensile and shear stresses.

TYPICAL SPECIFICATION CLAUSES

EXPLANATORY NOTES

reinforcement shall be lapped a minimum of 450 mm (18 in.) at joints.

**Chimney shaft linings**

Chimney shaft linings shall be formed of a 115 mm ( $4\frac{1}{2}$  in.) lining of Messrs X or other approved solid grade insulating blocks jointed in mortar composed of one part Portland cement and four parts of Messrs X No. 6 F powder or other approved mix. The linings shall be tied to the main brickwork with galvanised steel ties, as specified, 1 metre (3 ft) apart and in every third course.

Tall chimney shafts often have an inner lining of special heat-resisting bricks. As the lining is not bonded to the main brickwork, it is necessary to insert ties connecting the two.

Clauses covering any other special classes of brickwork, such as glazed bricks and brick arches, can conveniently follow at this stage.

MASONRY

**Dressed stonework**

All dressed stone shall be sandstone obtained from Messrs X's quarry and shall be free from vents, clayholes, discolourations or other defects and be of even texture and colour. The stone shall be laid on its natural or quarry bed.

All dressed stone is to match in colour and texture the samples of stone submitted to and approved by the Engineer. Every stone shall ring clearly when struck with a hammer.

The mortar for bedding and jointing shall consist of one part ordinary Portland cement to B.S. 12, one part lime and six parts sand. The lime shall be semi-hydraulic lime conforming to B.S. 890, Part I, class B, and the sand shall comply with B.S. 1200 (grading as Table 1).

Dressed stone or ashlar is usually employed as a stone face to a rubble, brick or concrete wall, to produce a first-class finish and possibly to harmonise with walling in the vicinity of the job.

Ashlar is usually defined as masonry consisting of fine blocks of stone, finely square-dressed to given dimensions and laid in courses of not less than 300 mm (12 in.) in height with fine joints.

The specification clauses should preferably begin with material requirements and then follow with details of workmanship.



#### TYPICAL SPECIFICATION CLAUSES

Each stone shall be set on a full mortar bed not less than 5 mm ( $\frac{3}{16}$  in.) thick and the beds shall be damped with water before setting the stonework. All stonework shall be carried out in general conformity with CP 121.201.

Each stone shall be of the dimensions shown on the Drawings and the backs shall be dressed at right angles to the bed. All beds shall be set horizontally and dressed to even surfaces throughout. All joints shall be dressed for the full depth of the stone and the exposed faces shall be chiselled to a fair surface.

The whole of the dressed stone shall be set in gauged mortar (1:1:6) and neatly jointed as the work proceeds. Clean down all exposed faces of dressed stone to remove all dirt and mortar stains and leave in perfect condition free from any defacement.

The prices for dressed stone shall include for chiselled exposed faces, preparatory labours, beds, joints, back faces, sunk faces, splays, transporting, storage, hoisting, setting in mortar and jointing as the work proceeds.

No stonework shall proceed when the temperature falls below 1°C (34°F) and all work must be adequately protected with sacking, tarpaulins or other suitable material against frost and rain. Any work damaged by frost or rain shall be relaid with fresh mortar at the Contractor's expense.

The Contractor shall suitably protect all dressed stonework and make good any damaged stonework at his own expense and to the satisfaction of the Engineer. Any chipped or broken stones shall be cut out and replaced.

#### EXPLANATORY NOTES

To obtain a satisfactory finish to the stonework, it is necessary for the stones to be carefully dressed and laid with fine joints. Provision should also be made for the protection of the stonework from damage by frost, rain or other causes and for the replacement of damaged work by the Contractor at his own expense.

Mason's mortars are sometimes used in preference to gauged mortars, a common mix by volume being:  
12 parts crushed stone  
3 parts lime putty or hydrated lime  
1 part Portland cement.

**Rubble walls**

*Squared rubble, built to courses.* Squared rubble shall consist of approved stone from Messrs X's quarry and no stones shall be less than 225 mm (9 in.) long, 150 mm (6 in.) wide and 100 mm (4 in.) deep. All stones shall be roughly squared and dressed smooth on beds and joints for a distance of at least 100 mm (4 in.) from the exposed face. Bond stones shall be provided at the rate of at least one to each square metre (sq. yd) of exposed face: they shall measure at least 150 mm × 150 mm (6 in. × 6 in.) on the face and extend for three-quarters of the thickness of the wall. Vertical joints shall not extend past more than three stones and the horizontal lapping of stones shall be not less than 100 mm (4 in.). The stonework shall be levelled up at intervals of about 600 mm (24 in.), and all stones shall be solidly bedded and jointed in gauged mortar (1:1:6) with flush joints as the work proceeds.

*Random rubble, uncoursed.* Random rubble shall consist of approved stone from Messrs X's quarry, carefully selected by the mason or waller to obtain a good bond and shall be hammer-pitched on exposed surfaces. Bond stones shall be provided at the rate of at least one to each square yard of exposed face, they shall measure at least 150 mm × 150 mm (6 in. × 6 in.) on the face and extend for three-quarters of the thickness of the wall.

Stones shall be solidly bedded and jointed in gauged mortar (1:1:6) with flush joints as the work proceeds. The

In squared rubble the stones are roughly squared and small stones are sometimes introduced to assist bonding. These are generally referred to as 'sneck' stones. In work built to courses the stonework is levelled up at intervals varying between 300 mm (12 in.) and 1 m (36 in.) in the height of the wall. This form of walling provides a reasonably economical and regular stone finish. Squared rubble can also be built coursed or uncoursed.

Random rubble may be uncoursed or brought to courses. This represents the cheapest form of stone walling and has an irregular appearance. Bond stones are needed to give the wall adequate strength and the interior voids are usually filled with small stones.

#### TYPICAL SPECIFICATION CLAUSES

interior spaces in the wall shall be filled with small pieces of stone grouted in position.

*Dry rubble walling.* Dry rubble boundary walls shall be constructed of approved stones of the type specified for random rubble. The stones shall be roughly dressed and laid on edge at a slope with the hearting formed of small stones. The stones shall be laid in such a manner that rain penetrating the outer face will run out at a lower level.

#### Special stonework

Coping stones in natural stone shall be of approved stone, dressed with a smooth finish to the shapes and dimensions shown on the working drawings, and shall comply with the requirements of B.S. 3798. The coping stones shall be laid to the correct lines and bedded and jointed in gauged mortar (1:1:6).

Quoins, plinths, voussoirs and other special stonework shall be of approved stone dressed to the finishes, shapes and dimensions shown on the working drawings and bedded and jointed in the manner indicated.

#### Dowels and cramps

Copper dowels, 25 mm (1 in.) square and 75 mm (3 in.) long, shall be fixed between column stones and in other positions indicated on the Drawings or where directed by the Engineer. The dowels shall penetrate an equal distance

#### EXPLANATORY NOTES

This type of walling is occasionally used for boundary walls in rural areas and is similar to uncoursed random rubble with the omission of mortar from the joints.

This clause refers the Contractor to the working drawings for some of the more detailed requirements. Where this procedure is adopted, it is essential that the Contractor should be supplied with these drawings at the time of tendering. Alternatively, a full description can be given in the specification, such as '375 mm × 150 mm (15 in. × 6 in.) parapet coping, weathered on top with 60 mm (2½ in.) throated projection at each edge'.

Both dowels and cramps are used to join stones together and keep them in their correct positions. Dowels are fixed in a vertical plane and cramps are used horizontally.

#### TYPICAL SPECIFICATION CLAUSES

into each stone and shall be set in cement mortar.

Gunmetal cramps, 225 mm (9 in.) long by 40 mm ( $1\frac{1}{2}$  in.) wide by 5 mm ( $\frac{1}{4}$  in.) thick with each end turned at right angles for a distance of 40 mm ( $1\frac{1}{2}$  in.), shall be provided at each joint between coping stones. The Contractor shall form suitable mortices to receive the cramps which shall be set in cement mortar. The cramps shall extend for an equal distance into each stone.

#### Cast stonework

Cast stone shall be obtained from an approved manufacturer and shall comply with the requirements of B.S. 1217. The facing shall be not less than 20 mm ( $\frac{3}{4}$  in.) thick and shall consist of one part of white Portland cement to three parts of Bath stone aggregate with a maximum size of 15 mm ( $\frac{1}{2}$  in.) The faces of the stones shall be smooth, even and free from crazing, and equal to samples submitted to and approved by the Engineer. Aggregates used in the concrete core shall comply with B.S. 882.

The Contractor shall be responsible for protecting cast stonework on the site. Metal bond ties shall be cast into the stones as shown on the Drawings or directed by the Engineer.

The stones shall be bedded and pointed in one operation with a mason's mortar consisting of one part Portland cement to two parts white hydrated cement and eight parts clean fine aggregate, all by volume. Facing stones shall be brought up in courses to a height not exceeding 1 m (3 ft) in one operation.

#### EXPLANATORY NOTES

As an alternative, slate can be used for both dowels and cramps. The metal used must be non-corrodible.

Cast stone is a material manufactured from cement and natural aggregate for use in a manner similar to and for the same purposes as natural stone. The term includes reconstructed stone and artificial stone.

Cast stone often consists of a comparatively thin facing incorporating crushed stone, around a core of structural concrete.

Reference should be made to B.S. 1217: Natural Stone, for basic requirements and any additional particulars added in the specification.

TYPICAL SPECIFICATION CLAUSES

EXPLANATORY NOTES

The concrete backing shall then be brought up and well compacted around the stones and projecting metal ties.

WATERPROOFING

**Asphalt**

Asphalt for tanking and damp-proof courses shall comply with the requirements of B.S. 1097 (mastic asphalt with limestone aggregate) or B.S. 1418 (mastic asphalt with natural rock asphalt aggregate).

The most efficient water-proofing membrane consists of asphalt, of which mastic asphalt is the most suitable for this purpose.

**Asphalt work**

All asphalt work shall be carried out by workmen experienced in the preparation and laying of mastic asphalt.

Horizontal membranes shall be laid in three thicknesses, each with 75 mm (3 in.) laps, to a total thickness of 30 mm ( $1\frac{1}{8}$  in.), and shall be carried through walls to connect with vertical membranes with a two-coat angle fillet in the manner shown on the Drawings. All surfaces to be covered with asphalt shall be dry and free from dirt or loose material immediately prior to the application of asphalt.

Vertical membranes shall be applied in three thicknesses with 75 mm (3 in.) laps, to a total thickness of not less than 20 mm ( $\frac{3}{4}$  in.).

Where necessary, protect the asphalt by laying loading coats of concrete as soon as each section of asphalt work is complete. Pumping shall be continued until the concrete loading coat is set.

To ensure satisfactory results it is necessary to lay the asphalt in a minimum number of coats with a minimum total thickness and the requirements vary for different situations. The accompanying specification clauses indicate the generally accepted minimum requirements. Other basic requirements include the provision of laps between adjoining coats of asphalt and two-coat angle fillets at the junction of horizontal and vertical work.

Asphalt tanking must be continuous and it should therefore be carried under stanchion bases by lining their pits. It is also important to protect all asphalt as the work proceeds. Where a

#### TYPICAL SPECIFICATION CLAUSES

Asphalt for use on roofs shall comply with B.S. 988 or B.S. 1162 and shall be laid to falls on an underlay of sheathing felt. Mastic asphalt to flat roofs shall be laid in two thicknesses with 75 mm (3 in.) laps, to a total thickness of not less than 20 mm ( $\frac{3}{4}$  in.). At the junctions of flat roofs and parapet walls, two-coat asphalt skirtings shall be provided 150 mm (6 in.) in height above the highest part of the roof. Two-coat angle fillets shall be provided at the junction of the skirting and the roof, and the top of the skirting shall be splayed, turned at least 25 mm (1 in.) into a groove in the brickwork or concrete, and pointed or connected to a damp-proof course in the parapet wall. Mastic asphalt roofing shall be laid in accordance with CP 144. 201.

#### Bitumen sheeting

Bitumen sheeting shall comply with B.S. 747 type 1C, weighing not less than 1 kg/m<sup>2</sup> (2½ lb/yd<sup>2</sup>). For roof coverings the sheeting shall be applied in three layers, the bottom layer being of asbestos based felt, type 2A, and the top layer shall be covered with white Derbyshire spar chippings set on a coat of cold dressing compound.

All surfaces shall be dry and free from dirt and loose material immediately prior to the application of bitumen primer or an approved cut-back bitumen solution of suitable viscosity. The sheeting shall be laid with laps of not less than 50 mm (2 in.), and a coat of hot oxidised or blown bitumen bonding compound shall be applied between adjacent sheets. Splayed or rounded

#### EXPLANATORY NOTES

horizontal layer of asphalt is to be covered by reinforced concrete, it is advisable to lay a 50 mm (2 in.) layer of concrete in advance of the laying of the reinforcement to avoid damage to the asphalt.

An alternative and cheaper form of waterproofing is provided by the use of bitumen sheeting. The sheeting should conform to one of the classes detailed in B.S. 747, it should be properly lapped, and each sheet should be fixed and sealed with hot bitumen to ensure a sound and waterproof job.

TYPICAL SPECIFICATION CLAUSES

EXPLANATORY NOTES

angle fillets shall be provided at the junction of horizontal and vertical surfaces.

Bitumen felt roof coverings shall be laid in accordance with CP 144.101: Bitumen Felt Roof Coverings. The Contractor shall be responsible for the protection of all bitumen sheeting throughout the period of the Contract.