

# Wienerberger Technical Guidance

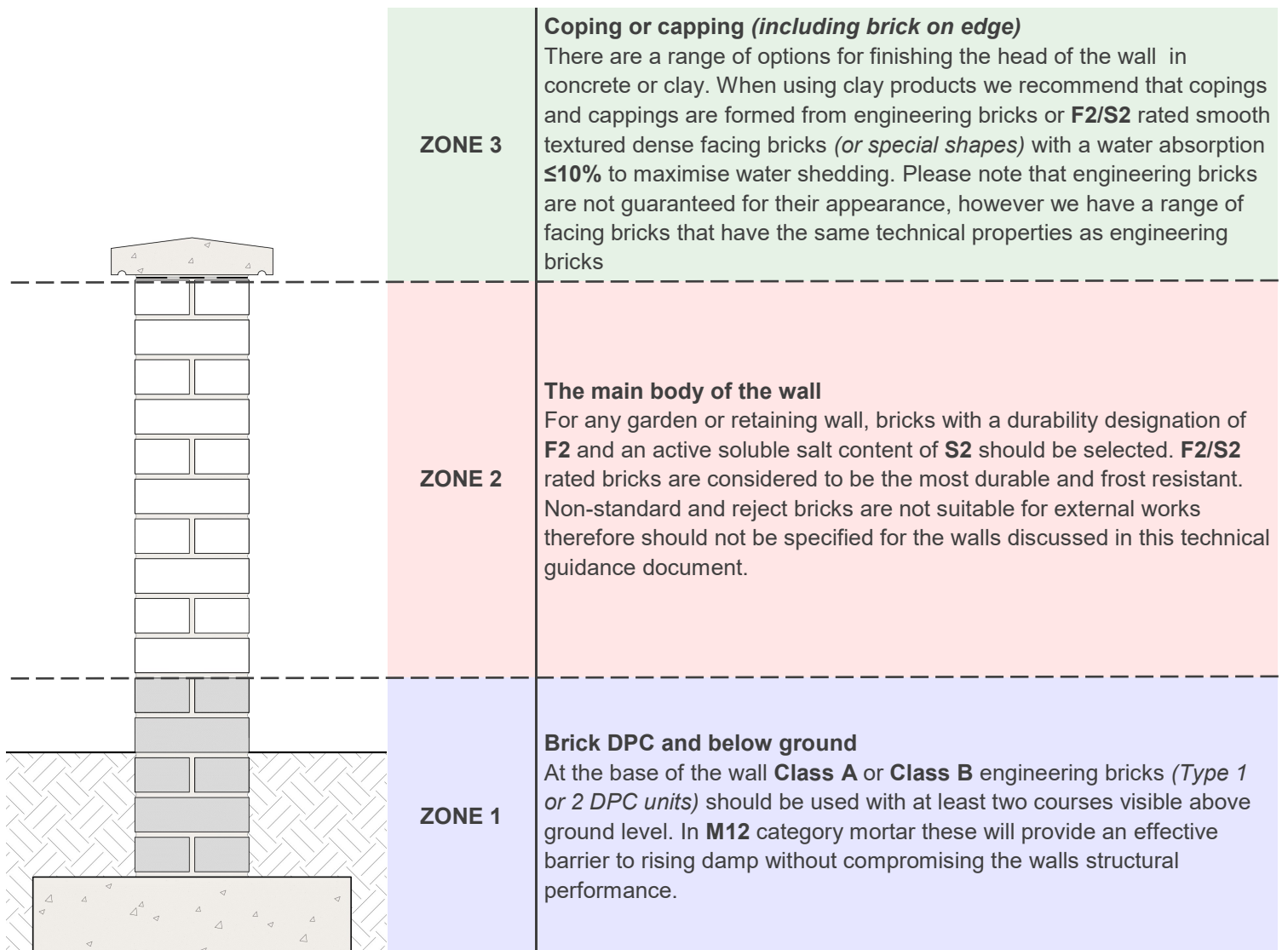
## GARDEN & RETAINING WALLS

### OUTLINE & BRICK SELECTION

Correct construction and detailing of freestanding garden and retaining walls is important to ensure long term performance. These structures are especially at risk irrespective of geographical location, because they are often in exposed and unprotected areas and are subject to saturation, frost, sulphates and low temperatures. This document brings together guidance from a wide range of reference documents (e.g. PD 6697 and BS EN 1996-2) and complements the Brick Developments Association's guidance on Severely Exposed brickwork.

To ensure satisfactory performance the choice of brick for these structures also needs to be complemented by appropriate design and detailing and by good site practice during the construction process. Ultimately, detailing to minimise the amount of water/rain that can penetrate masonry will prolong its life. This guide deals with all of these issues and has been written with the aim of getting the best from Wienerberger products.

To aid with detailing and brick selection garden and retaining wall construction has been split into 3 distinct zones:



**MORTAR**

There are a number of factors that will influence mortar specification such as location, brick type, level of exposure, site specific conditions etc. Consideration needs to be given to the appropriate mortar specifications for different applications. Further guidance on this can be found in the Brick Development Association guidance on Severely Exposed Brickwork.

We would also recommend that PD 6697 (*Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2*) is referred to and where possible that the proposed mortar supplier is consulted for specialist advice.

For general guidance we recommend the following mortar strengths/mixes:

**M12** For capping's, copings and work at and below the base brick DPC – when using wirecut (perforated) bricks.

**M6** For the main body of the wall in all exposure zones.

**TABLE 1 : BRITISH STANDARD CATEGORISATION OF MORARS**

Table NA2 in the National Annex to BS EN 1996-1-1 (*Eurocode 6*)

Mortar Designation	Compressive Strength Class	Prescribed Mortars (proportion of materials by volume)				Compressive strength at 28 days (N/mm <sup>2</sup> )
		Cement : Lime : Sand with or without air entrainment	Cement : Sand with or without air entrainment	Masonry Cement <sup>a</sup> : Sand	Masonry Cement <sup>b</sup> : Sand	
(i)	M12	1 : 0 to ¼ : 3	-	-	-	12
(ii)	M6	1 : ½ : 4 to 4½	1 : 3 to 4	1 : 2½ to 3½	1 : 3	6

Masonry Cement <sup>a</sup> (inorganic filler other than lime)  
Masonry Cement <sup>b</sup> (lime)

Proportioning by mass will give more accurate batching than proportioning by volume, providing that the bulk densities of the materials are checked on site.

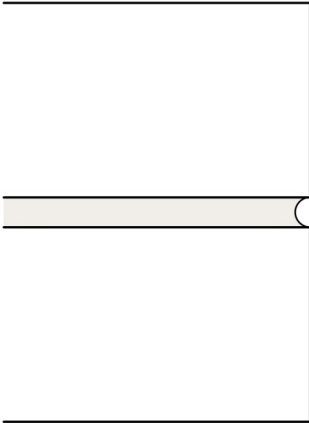
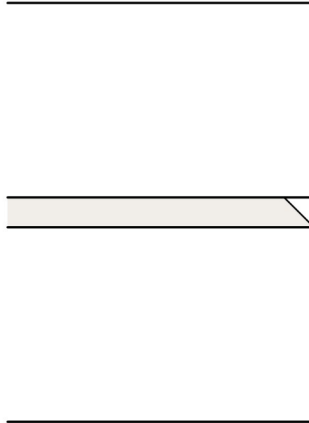
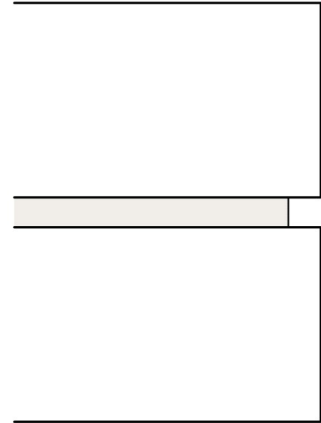
When the sand proportion is given as, for example, 4 to 5, the lower figure should be used with sands containing a higher proportion of fines whilst the higher figure should be used with sands containing a lower proportion of fines.

**SULPHATE ATTACK**

If there are sufficient soluble salts or sulphates present in a mortar containing tri-calcium aluminate (C3A) and there is enough water present (for long enough) expansion of the mortar can be caused, eventually causing total disruption of the mortar joints. This rare problem is called sulphate attack.

The salts/sulphates usually come from the earth behind a retaining wall, from salts used for de-icing purposes or very rarely from the bricks themselves. To reduce the risk of sulphate attack, S2 designation bricks should be specified. Design and construction measures should minimise the ingress of water into the brickwork for example DPC's, copings, DPM's behind retaining walls and paving laid to fall away from the wall.

A further precautionary measure would be to use sulphate resisting types of cement (SR grades) where there is a risk of contamination from fill materials or road salts.

**MORTAR JOINT PROFILES**

**Bucket handle mortar joint  
(preferred)**

**Weather struck mortar joint**

**Recessed mortar joint  
(not recommended)**

To maximise the water shedding properties of the brickwork it is advised that mortar joint profiles have a bucket handle (preferred) or weather struck finish. It is also important that any joint is well tooled. Recessed joints are not recommended because they hold water, encourage longer term staining and are less resistant to rain penetration.

**DAMP PROOF COURSES & WATERPROOFING**

The use of a high-bond DPC near the head of the wall is recommended by Wienerberger and is included in Codes of Practice to provide additional protection from saturation to the brickwork below. DPC's should be sandwiched in fresh mortar.

In retaining walls it is important that a waterproofing membrane (DPM) or liquid applied coating should be applied to the rear face to prevent percolation of water and the effect of longer term staining from ground salts and leaching of mortar. This DPM should be protected from damage by a suitable protective board.

At the base of the wall sheet DPC's should not be used. The use of two or more courses of Class A or Class B Engineering bricks in M12 category mortar will provide good resistance to rising dampness without affecting structural performance.

Sealants to the visible face of brickwork are not recommended by the brick industry including Wienerberger. There is a risk of any sealant cracking and allowing moisture to penetrate and become trapped within the brick which can have a detrimental effect on the future durability of the brickwork.

**COPING & CAPPING OF BRICKWORK**

Correct finishing of the head of a wall adds visual appeal and has important benefits in terms of protecting the brickwork beneath from water ingress and staining. Copings and cappings can be manufactured in concrete or clay and can vary in appearance. In clay a series of standard shapes are available under BS4729 (Specification for dimensions of bricks of special shapes and sizes) and if required bespoke units can be designed and manufactured specifically for a project. When using clay products it is important that a dense facing brick type with a durability designation of F2/S2 and a water absorption  $\leq 10\%$  is selected. A smooth texture is preferable to maximise water shedding.

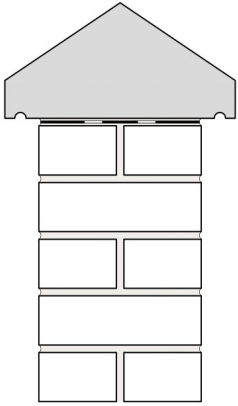
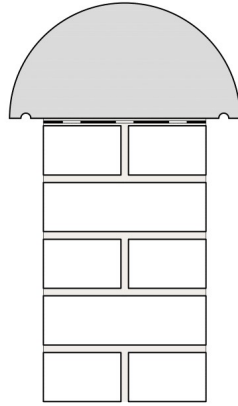
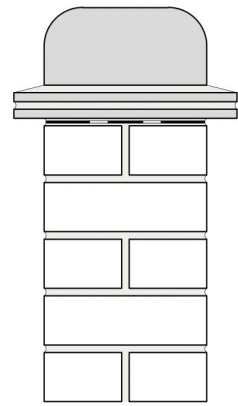
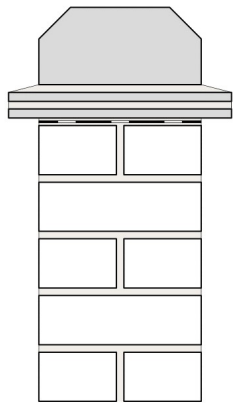
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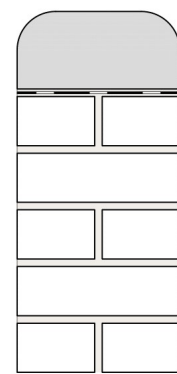
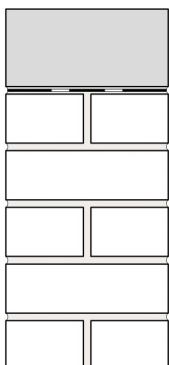
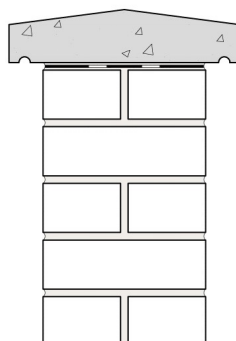
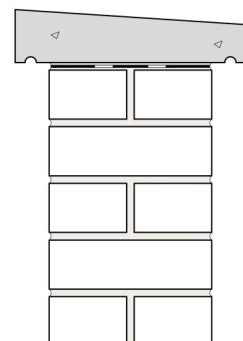
**Capping**     *Sits flush with the vertical face of the wall.*

**Coping**        *Projects at least 40mm from both sides of the wall and incorporates a drip on the underside.*

**COPING & CAPPING OF BRICKWORK**
**(CONTINUED)**

Copings provide better protection because they shed water clear of the vertical face of the wall. Creasing tiles still require a flexible DPC below the tiles to prevent percolation of water through the wall. By projecting them from both faces of the wall (*minimum 40mm*) they can provide a protective drip feature to form a coping detail. A minimum of two courses should be specified with staggered joints.

**EXAMPLES OF CLAY & CONCRETE COPINGS & CAPPINGS**

**Saddleback coping**

**Half-round coping**

**Creasing tiles (*40mm projection*) & double bullnose to form coping**

**Creasing tiles (*40mm projection*) & double cant brick to form coping**

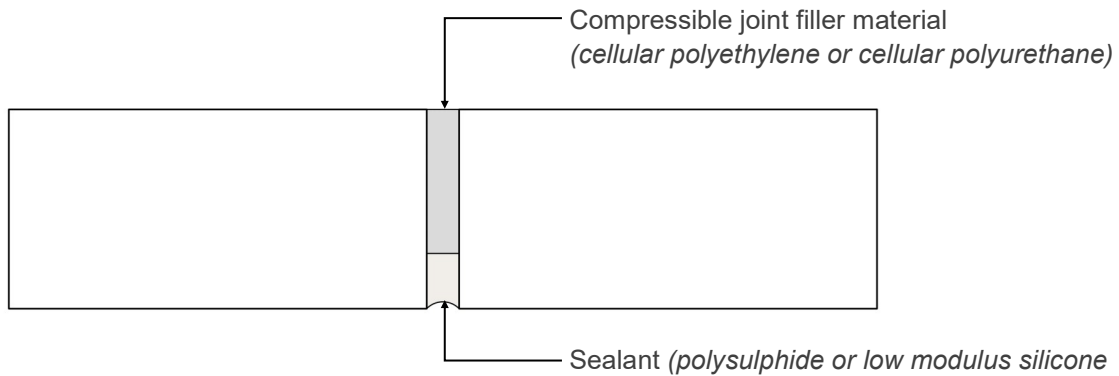
**Half-round capping**

**Double bullnose capping**

**Brick on edge capping**

**Twice weathered concrete coping**

**Once weathered concrete coping**

**MOVEMENT JOINTS**

Clay bricks, like all materials, expand and contract as temperature rises and falls. Whilst thermal expansion of the brick will occur due to the range of temperatures experienced, the orientation of walls and the colour of the brick, a greater influence on the overall movement of clay bricks is the long term effect of moisture. The location and size of movement joints must therefore take into account the overall thermal and moisture movement characteristics of the product, the design and the dimensions of brickwork panels, and their relationship in plan form.

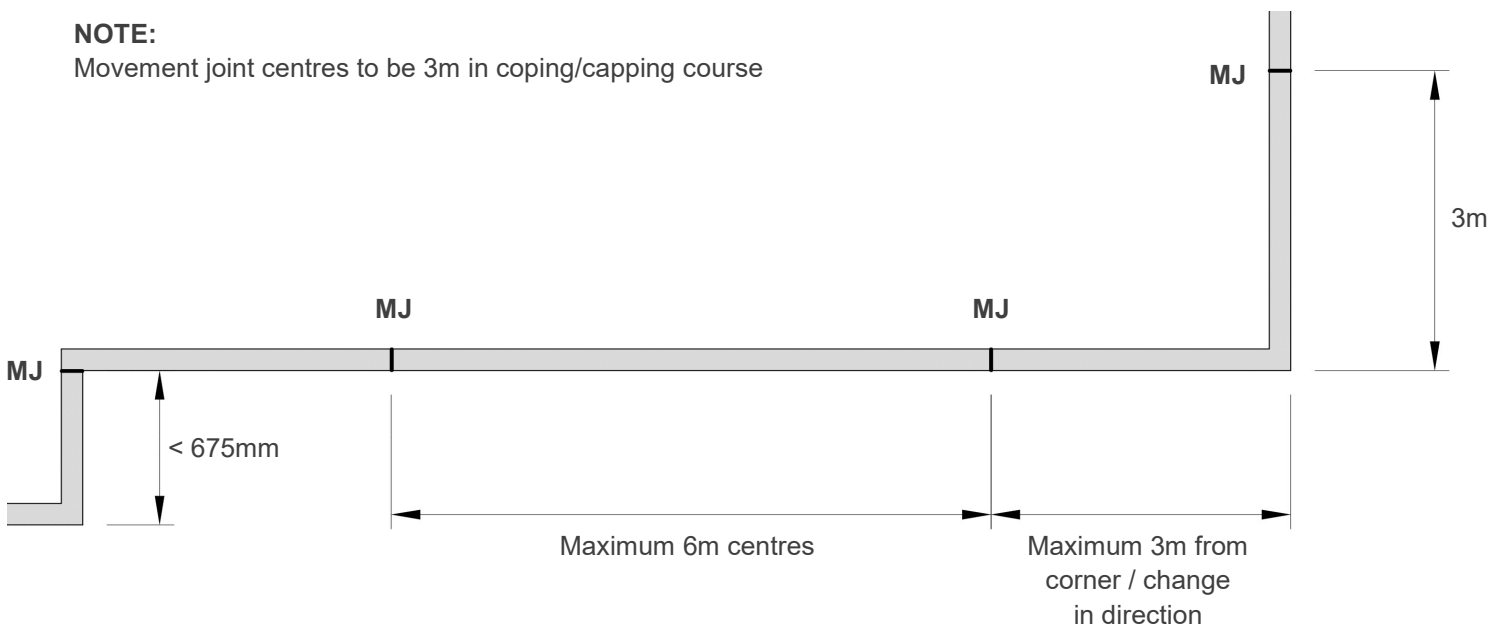
*In garden and retaining walls a movement joint spacing of maximum 6m is advised.  
(3m in the coping/capping course)*

Vertical joints should commence from foundation level and extend through any coping or capping feature. It is important that an easily compressible joint filler material is specified. Cellular polyethylene and cellular polyurethane are ideal materials. The face sealant should offer long term protection of the joint filler and various sealant colours are available to complement mortar colours.



**Typical Movement Joint Detail**

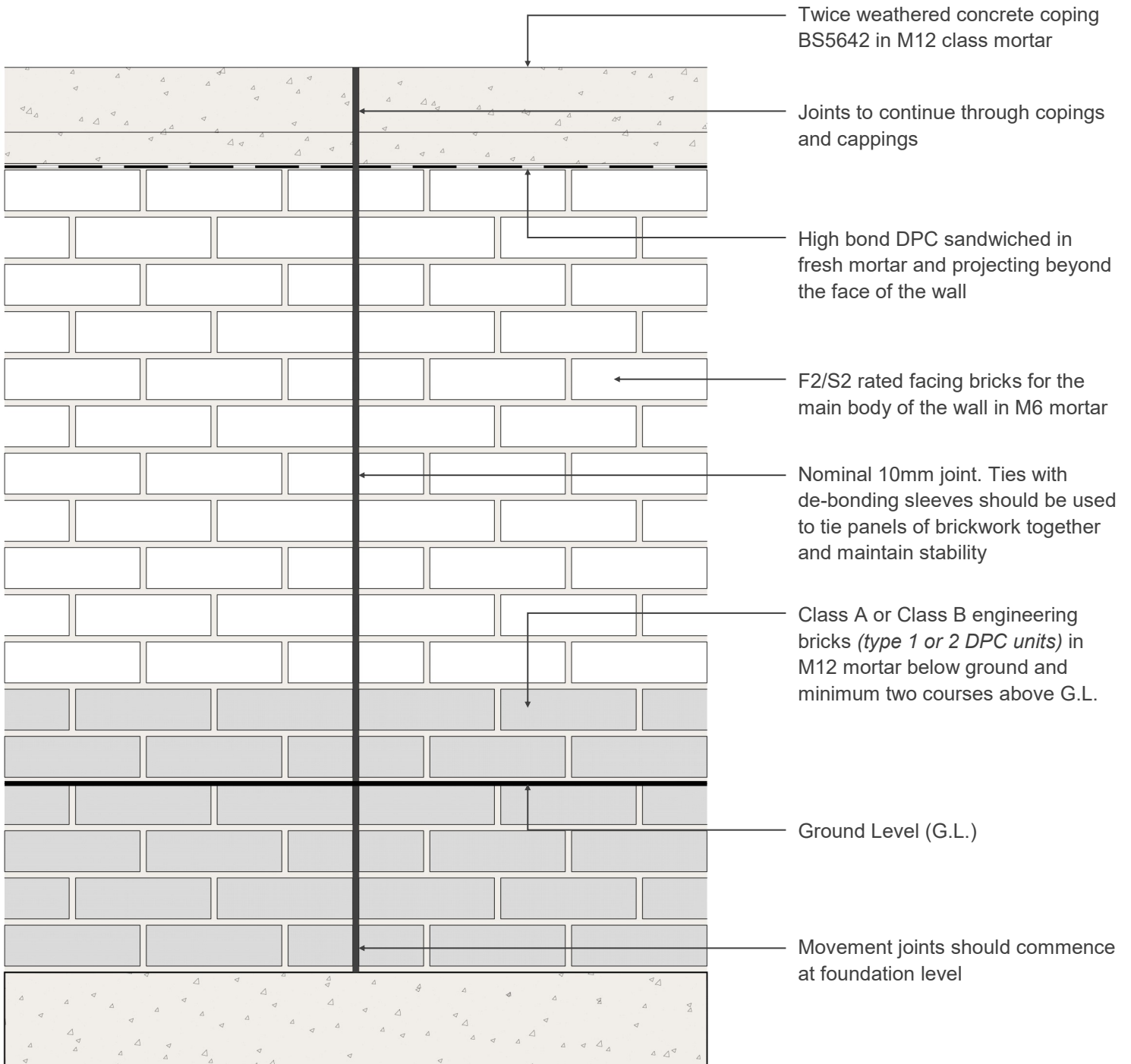
**NOTE:**  
Movement joint centres to be 3m in coping/capping course



**Recommended movement joint location plan in freestanding and retaining walls**

MOVEMENT JOINTS

(CONTINUED)



Typical elevation movement joint detail

## DRAINAGE

Water accumulating behind a retaining wall exerts pressure and needs to be released. This is critical to prevent structural damage. This can be achieved by incorporating a drainage layer, generally a granular material (gravel), with land drains and weep holes at regular intervals. A plastic pipe through the wall will normally suffice. Leaving open perpendicular joints to release water can lead to localised wall saturation and staining, with potential effects on long term durability. Gravel 'splash' strips adjacent to the wall faces, at ground level, reduce the risk of saturation near the base of the wall. Adjacent paving should be laid to falls, sloping away from the wall, to reduce the saturation risk.

## STRUCTURAL CONSIDERATIONS

This guide deals with the design for durability of domestic garden and retaining walls where forces and loadings are minimal. Professional guidance should be obtained for retaining walls above 1m in height and for freestanding walls above 1.2m to ensure that all structural considerations are taken into account.

## FURTHER INFORMATION & RESOURCES

### **Severely Exposed Brickwork**

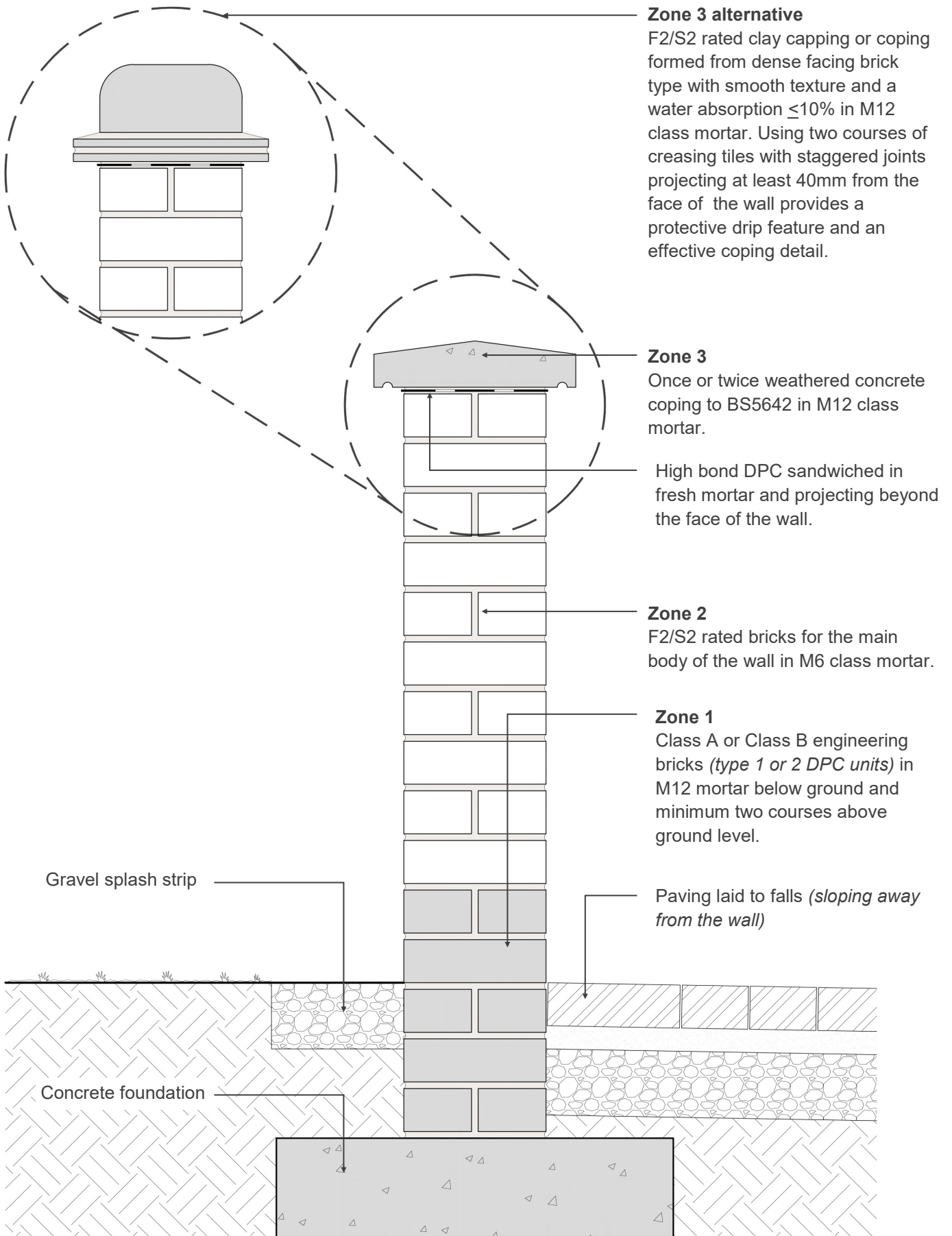
*Brick Development Association guide*

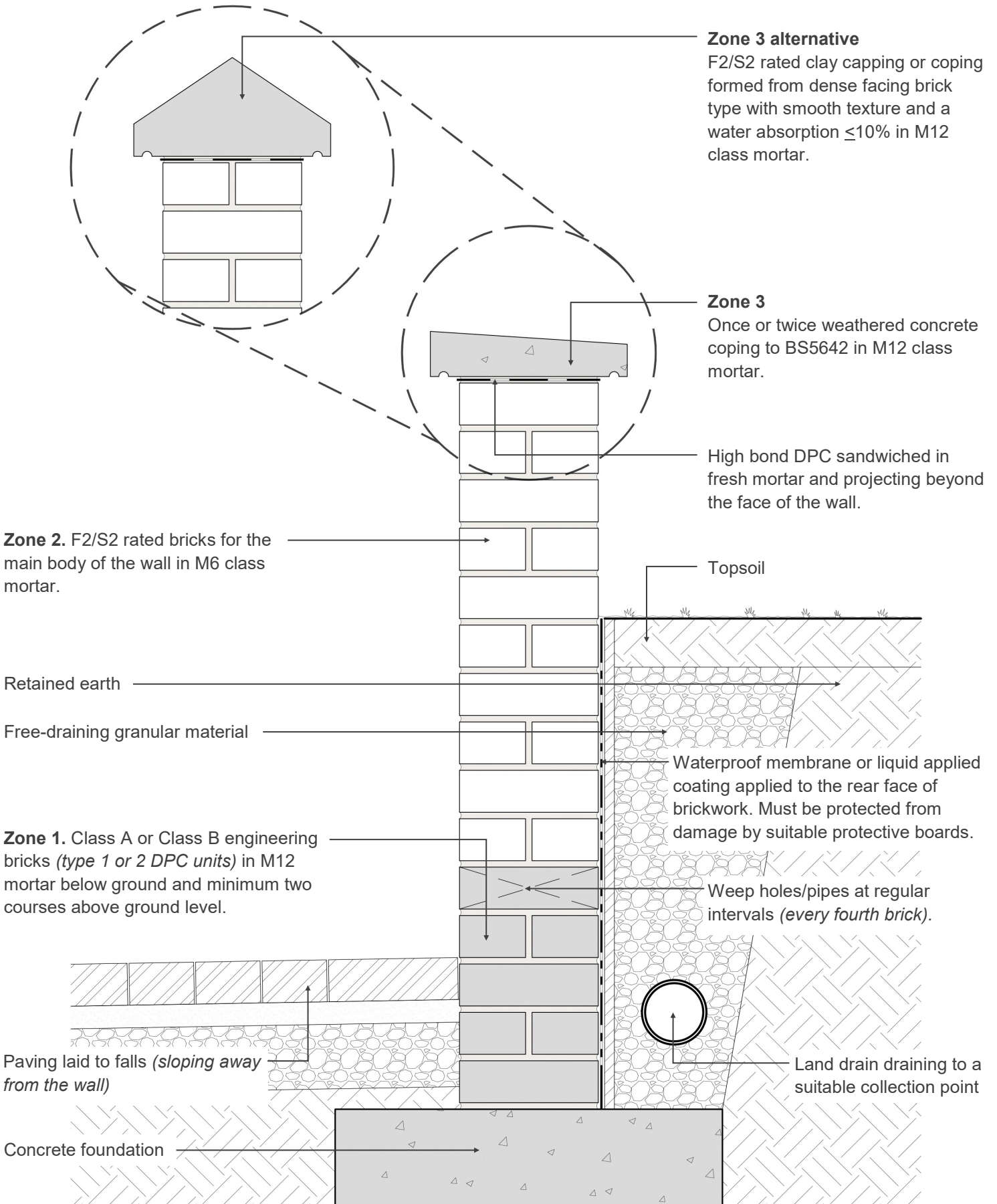
### **PD 6697**

*Design recommendations for masonry structures to BS EN 1996-1-1 and BS EN 1996-2*

### **BS 8000-3**

*Workmanship on Building Sites – Part 3: Code of Practice for Masonry*

**EXAMPLE WALL SECTIONS**


**EXAMPLE WALL SECTIONS**


**CHECKLIST OF ESSENTIAL POINTS**

<b>Freestanding and retaining walls:</b>	<b>Yes</b>	<b>No</b>
At the base of the wall have Class A or Class B Engineering bricks (DPC units - type 1 or 2) in M12 category mortar been specified with at least two courses visible above ground level?		
Has a brick with a durability designation of F2 and an active soluble salt content of S2 been selected for the main body of the wall?		
Has a suitable coping or capping been selected and detailed correctly?		
Has a high bond DPC sandwiched in fresh mortar been included below the coping/capping?		
Has the mortar been specified correctly and joint profile selected (bucket handle joint preferred)?		
Have movement joints been considered at maximum 6m centres (including at 3m centres for copings and cappings)?		
Has paving adjacent to the wall been laid to falls, sloping away or alternatively have gravel 'splash' strips been included?		

<b>Additional considerations for retaining walls:</b>	<b>Yes</b>	<b>No</b>
Has a waterproofing membrane (DPM) or liquid applied coating been specified for application to the rear face of any retaining wall? This needs to be protected from damage.		
Have weep holes/pipes been included at regular intervals to prevent water retention behind any retaining wall?		
Has the risk of sulphate attack been considered and if necessary the correct materials and details specified to prevent it from occurring?		