



## DESIGN & SPECIFICATION CONSIDERATIONS

# DURABILITY – SPECIFICATION BEST PRACTICE

The inherent durability of masonry is evident by the number of 16th century buildings and structures still standing or being used today. Their longevity is related to their design and workmanship and materials chosen for the local conditions.

Three of the potentially destructive agents affecting masonry are;

- Water
- Frost
- Temperature Change

Brickwork absorbs water falling as wind driven rain washing over the surface. Some areas will absorb more water than others, notably horizontal and inclined surfaces and parts in contact with the soil, and these may be potentially at risk from frost attack.

### FROST ATTACK

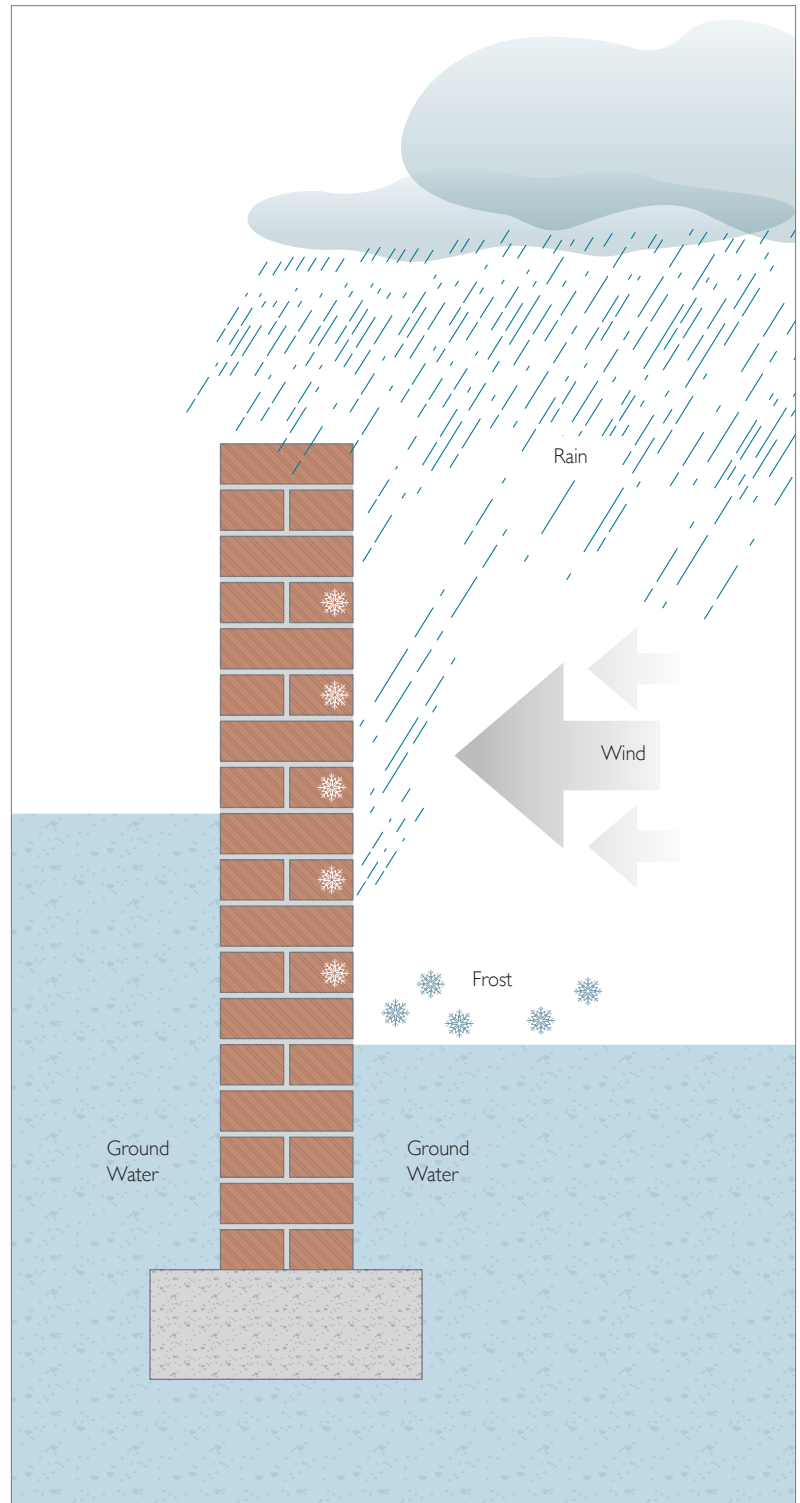
The repeated action of rain - water freezing and subsequently thawing in saturated brickwork can cause spalling of the brick surface.

### SULPHATE ATTACK

In saturated brickwork soluble salts from certain types of bricks or surrounding materials may cause a chemical reaction with a constituent of the Portland cement in the mortar. The surface of the mortar joint will crack, and the inside will crumble and expand, disrupting the brickwork.



Frost attack.





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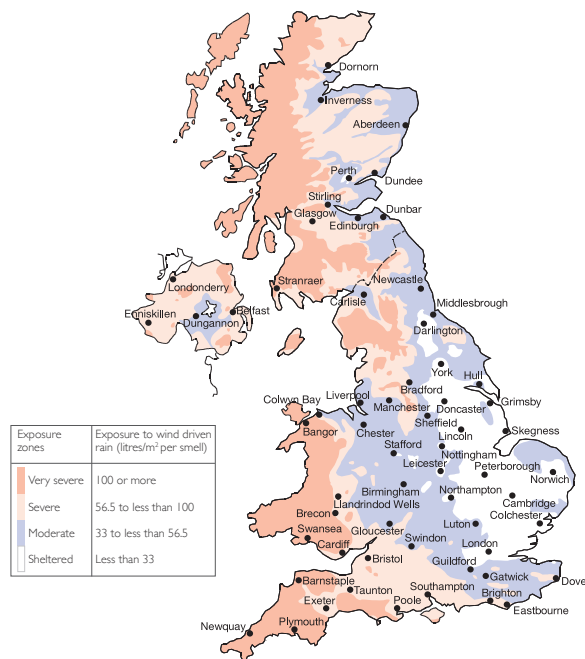
### EXPOSURE

The country can be divided into areas rated as sheltered, moderate, severe and very severe exposure to wind driven rain based on extensive metrological studies. There is a link between high exposure areas and the likelihood of brickwork suffering the consequences of frost attack if design, detailing and construction have not been properly addressed.

All areas within 8km of the coast and major river estuaries should be considered as being one 'grade' of exposure higher than that indicated on the map. The same applies to high buildings or buildings on high ground. The degrees of exposure will also depend on the position of the brickwork in the building or structure and the way in which the detail has been designed.

Generally external works such as retaining walls, garden walls and copings, and building features such as sloping areas, parapets, sills and areas between ground level and DPC are subject to more severe exposure than the rest of the building. This coupled with the geographical location classed as severe or very severe must be designed and constructed with due consideration.

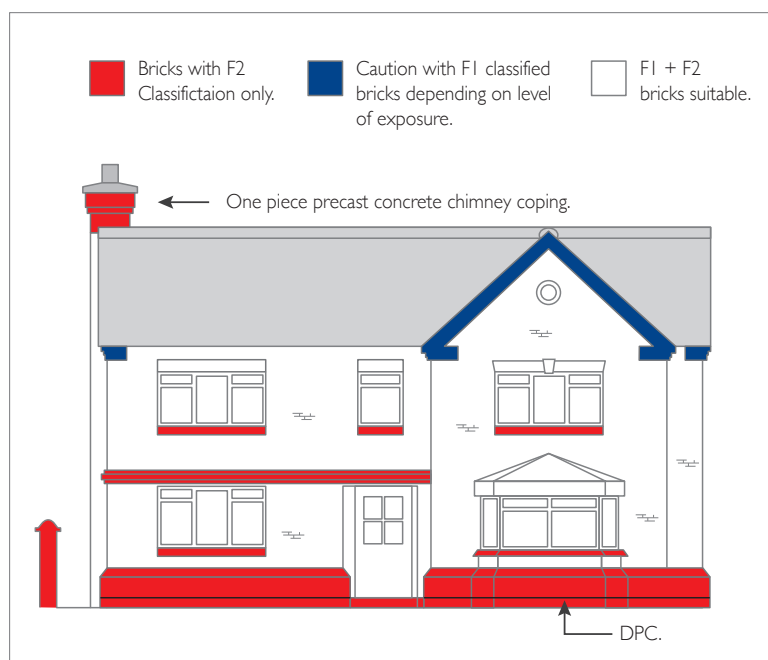
**Please refer to our Technical Information Sheets C14 and C15 for retaining and free-standing walls for further information on correct construction techniques. Failure to follow our recommendations will result in the durability warranty being invalidated should a problem arise.**



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### USE THE RIGHT BRICK FOR THE JOB

All clay bricks have a durability designation rating and it is important to know which bricks to use and where.



#### Bricks fall into three durability categories.

**F2** – Frost resistant – can be used in all normal building situations and degrees of exposure.

**F1** – Moderately frost resistant are also durable except where they may remain saturated and are subjected to repeated freezing and thawing. Generally they can be used between DPC and eaves although caution should be exercised on sites in elevated, exposed locations.

F1 rated products should not be used;

- Below ground level DPC.
- For cills
- For coping/cappings
- Beneath cappings
- In projecting details (plinths)
- In exposed site locations.
- In landscaping.

**F0** – Not frost resistant – should not be used externally.

**Note:** Bricks with any of these ratings do not look different so ask your supplier for the rating. If bricks are not rated they should be assumed to be '0' not frost resistant. F2 products may be covered by a durability warranty however this will be invalidated if the correct design details are not applied.



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#### MORTARS

Mortar joints are vulnerable to frost failure and general weathering and may require increased maintenance in regions rated as severe exposure to wind driven rain.

Mortar is an essential ingredient of brickwork and is subject to the same exposure as the brick. Generally a 1:1:6 mix (cement:lime:sand) will be sufficient for the majority of brickwork between dpc and eaves for buildings in sheltered and moderate regions.

For severe and very severe exposure regions increased mortar durability should be considered, however the mortar should not be stronger than the bricks used. Some stock bricks should not be used in conjunction with an M10 or higher strength mortar. Similarly a designation (i) mortar mix may not be suitable.

For bricks used between dpc and eaves a designation (ii) should be appropriate regardless of brick type. Or a compressive strength class no greater than M6.

For free-standing walls, brickwork below ground level dpc, chimneys, copings and cappings, sills and projecting details designation (i) will be more durable in the wetter locations and should be used where wire-cut bricks or Engineers have been specified. Stock bricks should remain with the designation (ii) however in particularly exposed regions in conjunction with exposed detailing, stock bricks may be inappropriate due to potential staining, algal growths and mortar specification.

Mortars suitable for use in severe environmental conditions		
Brick Type	Stock type bricks	Wirecut extruded bricks
Site made mix or factory proportioned pre-mix mortar (prescribed)	Designation (ii) 1: ½ : 4 ½ (cement:lime:sand) Or 1:4 ½ plus plasticizer	Designation (i) 1: 0 or ¼ : 3 (cement:lime:sand) Or 1:3 plus plasticizer
Factory designed mortar strength to EN 998:2	M6	M10 or M12

#### CLAY BRICK TYPES

**FACING** - Sold for appearance & available in a wide range of facing brick types, colours and textures. Some may not be suitable in positions of extreme exposure. Some have engineering properties. Beware, products downgraded to non-best for not achieving their technical specification may be available on the market which are not F2 durability. Always check with the supplier or manufacturer as they may only be suitable in footings or for internal applications.

**ENGINEERING** - Suitable for ground works, manholes and sewers, as ground level dpc to free-standing walls and situations where high strength and low water absorption are the most important factors. They are not sold for appearance.

**COMMONS/REJECTS** – These are only suitable for internal use or under protective claddings or in footings. They are not frost resistant.

#### MORTAR JOINT PROFILES - Refer to TIS A6 Mortar Joint Profiles

The long-term performance of the brickwork is highly dependent on the correct mortar joint profile for the efficient shedding of rainwater. Brickwork that remains saturated is more susceptible to frost damage.

The choice of joint profile should therefore be based on performance criteria as well as aesthetic considerations. These are the four most commonly used profiles.

**CURVED RECESSED (BUCKET HANDLE);** An efficient joint with a softer appearance.

**WEATHER STRUCK;** An efficient and attractive joint giving the shadow effect of a recessed profile but better weathering properties.

**FLUSH;** A common profile that is efficient in terms of shedding water if tooled, but will alter dramatically the overall colour of the brickwork.

**SQUARE RECESSED;** An attractive profile- but it should only be used in a sheltered location. It is not recommended for free-standing walls or any exposed situations. The depth of recess should be kept to a minimum necessary to achieve the desired appearance, but should not be greater than 3-4mm in areas rated as sheltered. Recessed joints should not be used where there is danger of prolonged saturation occurring.



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### VULNERABLE BRICKWORK

#### Sills, plinths, brick on edge cappings and chimneys.

Sills to window openings and projecting plinth brickwork are subject to greater exposure from rainfall than vertical walling—they will become saturated.

#### SILLS

Use only F2 rated special shaped bricks i.e. a single cant, plinth or sill brick to construct a sill, which will shed the water run-off from the glazing, protecting the brickwork below. Sills should ideally project to give the necessary protection to the bricks below.

#### PLINTHS

Any projecting plinth brickwork must also be F2 rated. Because of its position it is more exposed and in addition will receive water run-off.

#### COPINGS AND CAPPINGS

An overhanging coping with drip groove at the top of a wall is the preferred finish, especially in areas rated as severe exposure; they will help direct the water to fall clear of the brickwork below.

Cappings are generally flush with the walling. In all instances they must be F2 rated **and must be used in conjunction with a high bond DPC** which will help protect the walling below from saturation.

Brick on edge cappings may not be the most suitable method of topping a boundary wall in some geographically exposed locations. Their flat surface may attract water pooling and unless creasing tiles and DPC's are incorporated they will give little protection to brickwork beneath.

#### CHIMNEYS

In severe and moderate areas of the country chimney heads should be finished with a one piece overhanging coping in monolithic concrete to protect masonry beneath.

In sheltered areas deep concrete flaunching may be acceptable. Thermal fluctuations may cause concrete to develop fractures allowing water ingress therefore a damp proof membrane situated underneath the flaunching but on top of the brickwork will be required.

Decorative detailing should not allow water to pool on ledges.

**Note: The use of clay facing bricks for treads and risers for external steps in garden paths is not recommended.**

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