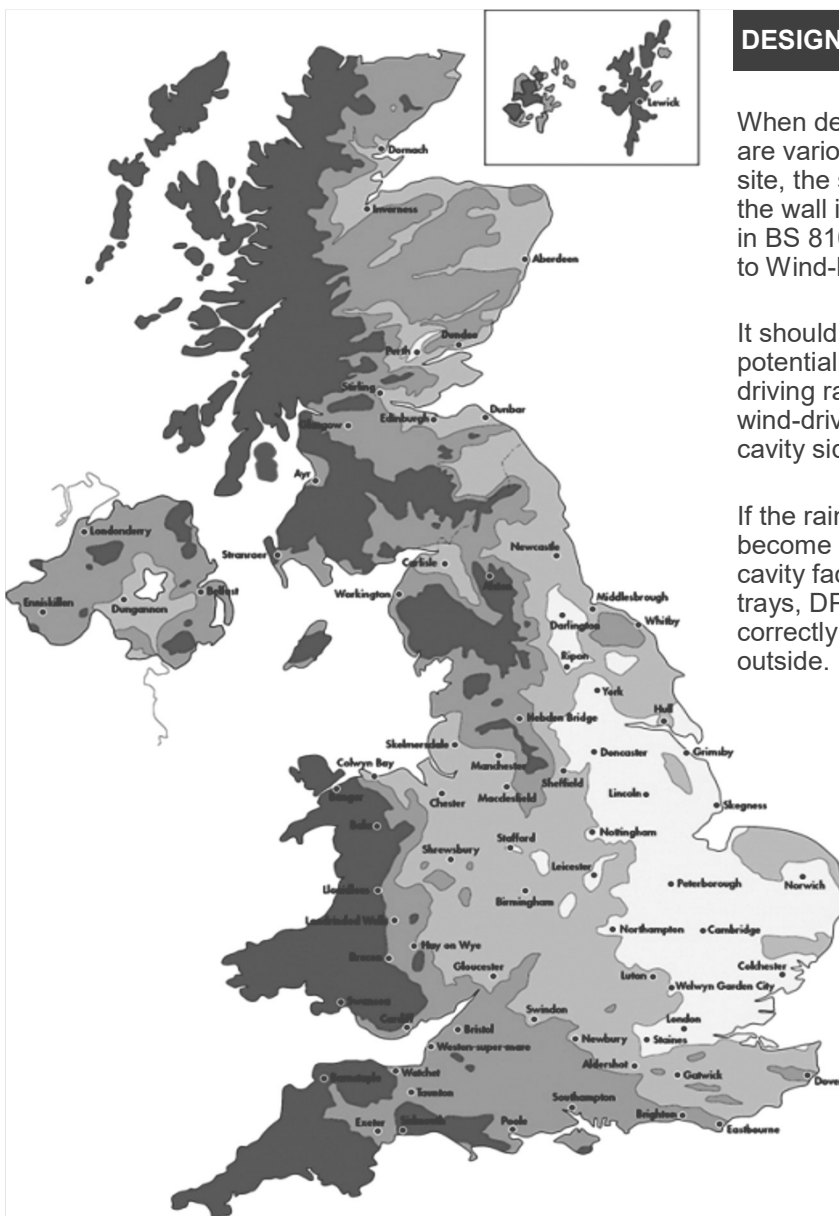


Wienerberger Technical Guidance

RAIN PENETRATION

During periods of rainfall, any defects in the external envelope will become apparent which can cause damage to internal finishes and also affect the efficiency of insulation in the cavity wall. Such defects are usually the result of lack of design consideration and/or poor workmanship and can be expensive to remediate.

The cavity was introduced in the UK in the 1930's to prevent water ingress to the inner finishes when designed and built correctly, unlike some forms of solid wall construction. Latterly, the cavity has become a convenient place to locate insulation, but this was not the prime function of the cavity wall.



DESIGN

When designing to resist the passage of wind driven rain, there are various factors to consider – the geographic location of the site, the surrounding topography and the proposed design of the wall in question. Further advice for designers can be found in BS 8104 'Code of Practice for Assessing Exposure of Walls to Wind-Driven Rain'.

It should be assumed that a single leaf of clay brickwork will potentially allow the ingress of rainwater under conditions of driving rain – brickwork is not waterproof. During periods of light wind-driven rain, damp patches may be evident at joints on the cavity side of the brickwork.

If the rain period is longer or more severe, the entire face may become wet and ultimately rainwater may run freely down the cavity face – this is why it is extremely important that cavity trays, DPC's and weepholes are designed and constructed correctly to divert rainwater from the cavity and drain it to the outside.

Approximate wind-driven rain (litres/m² per spell)

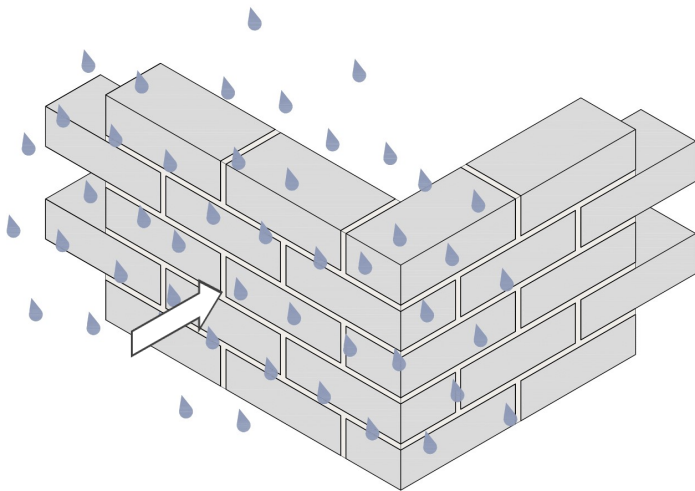
Very Severe		100 or more
Severe		56.5 to less than 100
Moderate		33 to less than 56.5
Sheltered		Less than 33

DESIGN
(CONTINUED)

For an outer leaf built with low water absorption bricks, such as engineering bricks, rainwater will primarily enter via the mortar joints after an initial fast run-off of water – this is referred to as the ‘raincoat’ effect.

For an outer leaf built with higher absorption bricks experiencing the same volume of wind-driven rain, rain penetration will be delayed but it will eventually occur if the period of rain continues for long enough so that the bricks become saturated – this is referred to as the ‘overcoat’ effect.

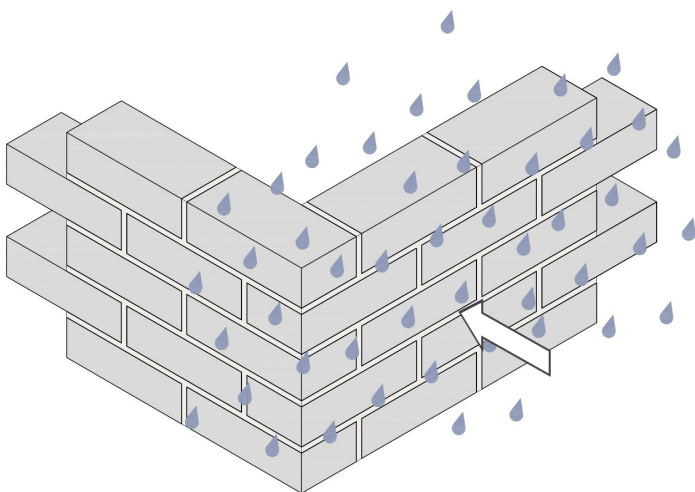
Designers should be aware that domestic garages constructed with a single skin of brickwork may result in damp patches on the internal side of the outer leaf, for the reasons described above. This can result in unhappy homeowners, particularly through the wet winter months.



Rain penetrates mainly through joints



Initial fast run-off : The **Raincoat** effect.

Low absorption bricks


Rain eventually penetrates through body of brick as well as joints



Rainwater initially absorbed : The **Overcoat** effect

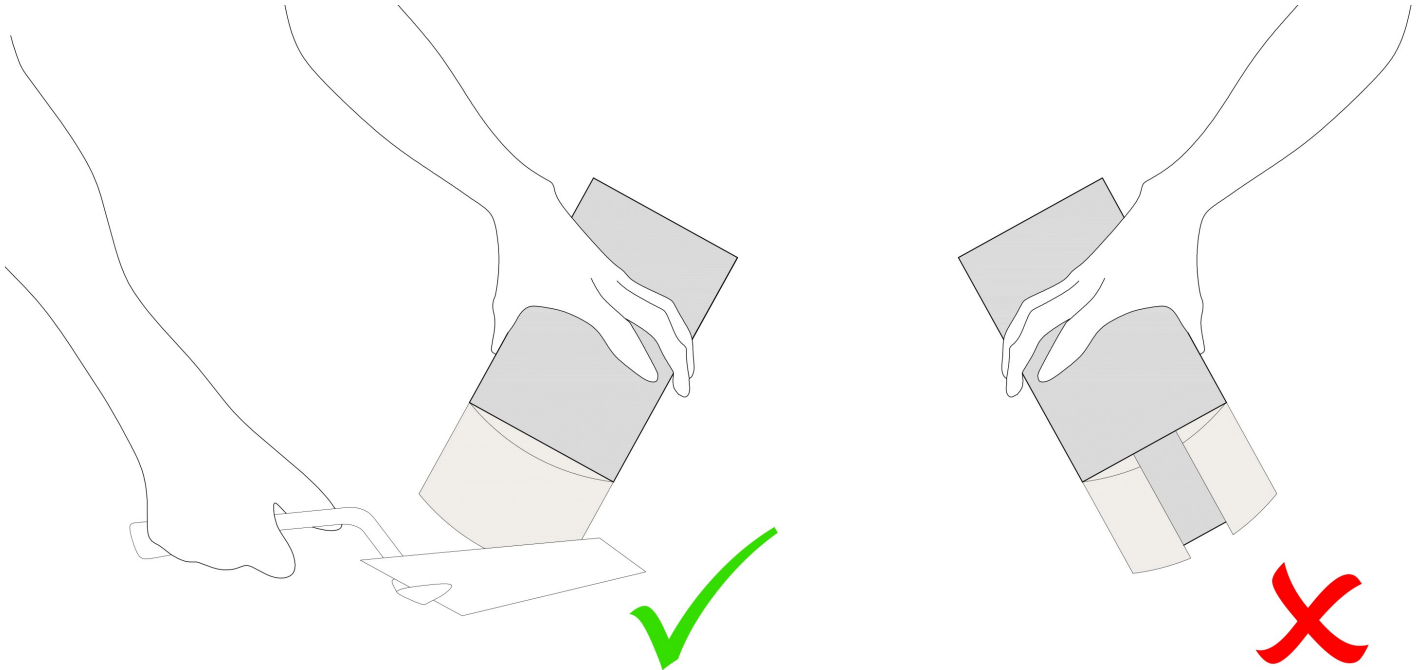
High absorption bricks

WORKMANSHIP

Bricklayers need to be aware of the contribution of mortar in resisting rain penetration in the outer leaf, and not just the brick type. Mortar bed and perpendicular (perp) joints should be fully filled.

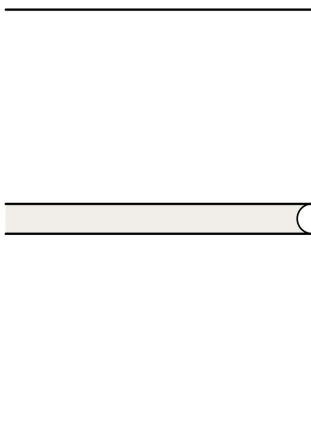
The practice of 'tipping and tailing' the header of the brick should be discouraged as it can result in a void in the joint, increasing the likelihood of rain penetration.

If the bricks are adjusted by the bricklayer once bedded, this can result in fine cracks due to the bond being broken between the brick and mortar interface, potentially allowing a path for water ingress.

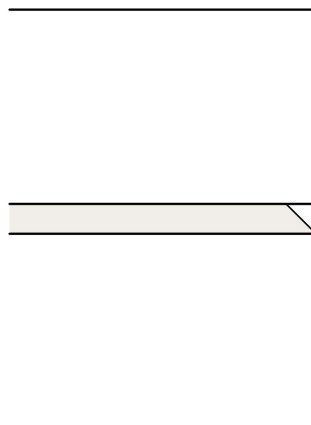


Tipping and tailing of brickwork

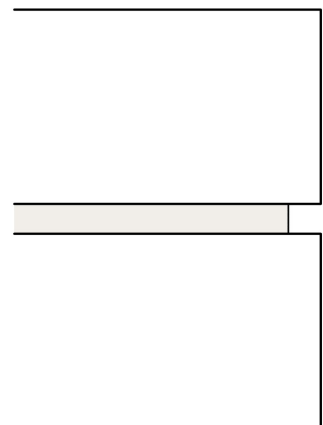
Mortar joint profiles can have a great influence over the rain resistance of the joint, and this should be the prime consideration from designers over the aesthetic impact on the brickwork. For example, recessed joints cannot be finished by 'tooling' with the trowel and can therefore allow increased water penetration - they should therefore only be used in sheltered locations. Bucket handle and weather struck profiles can be 'tooled' which compacts the mortar and provides greater resistance (see also 'Mortar').



Bucket handle mortar joint
(preferred)



Weather struck mortar joint



Recessed mortar joint
(not recommended)

WORKMANSHIP
(CONTINUED)

It is important that the bricklayers also understand the significance of mortar mixes in relation to rain resistance. The higher the cement content, the more rain resistant the joint will be. Mortar mixes should not be changed by the bricklayer without consultation with the designer.

BRITISH STANDARD CATEGORISATION OF MORTARS
Table NA2 in the National Annex to BS EN 1996-1-1 (Eurocode 6)

Compressive strength class ^a	Prescribed mortars (proportion of materials by volume) (see note)				Mortar designation	Suitable for use in Environmental condition
	cement ^b : lime : sand with or without air entrainment	cement ^b : sand with or without air entrainment	Masonry cement ^c : sand	Masonry cement ^d : sand		
M12	1 : 0 to ¼ : 3	1 : 3	Not suitable	Not suitable	(i)	Severe
M6	1 : ½ : 4 to 4½	1 : 3 to 4	1 : 2½ to 3½	1 : 3	(ii)	Severe
M4	1 : 1 : 5 to 6	1 : 5 to 6	1 : 4 to 5	1 : 3½ to 4	(iii)	Moderate
M2	1 : 2 : 8 to 9	1 : 7 to 8	1 : 5½ to 6½	1 : 4½	(iv)	Passive

a The number following the M is the compressive strength for the class at 28 days in

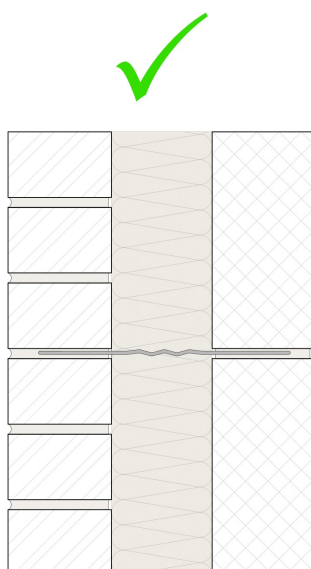
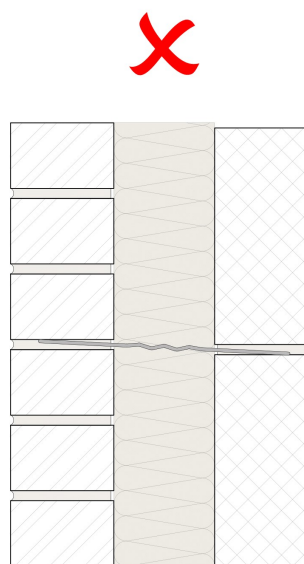
b Cement or combinations of cement (which include CEM I and many CEM IIs) in accordance with NA.2.3.2, except masonry cements

c Masonry cement in accordance with NA.2.3.2, (inorganic filler other than lime)

d Masonry cement in accordance with NA.2.3.2 (lime)

Note When the sand portion is given as, for example, 5 to 6, 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.

When a leaf of brickwork is constructed, it is important that the brickwork is kept to gauge – if it is not, then it is difficult to correctly locate wall ties. They should be positioned so that they are at least level or ideally slope down to the outer leaf, with the drip positioned downwards. Wall ties must also be kept clear of mortar snots and droppings which can be major cause of providing a bridge for moisture movement across the cavity.

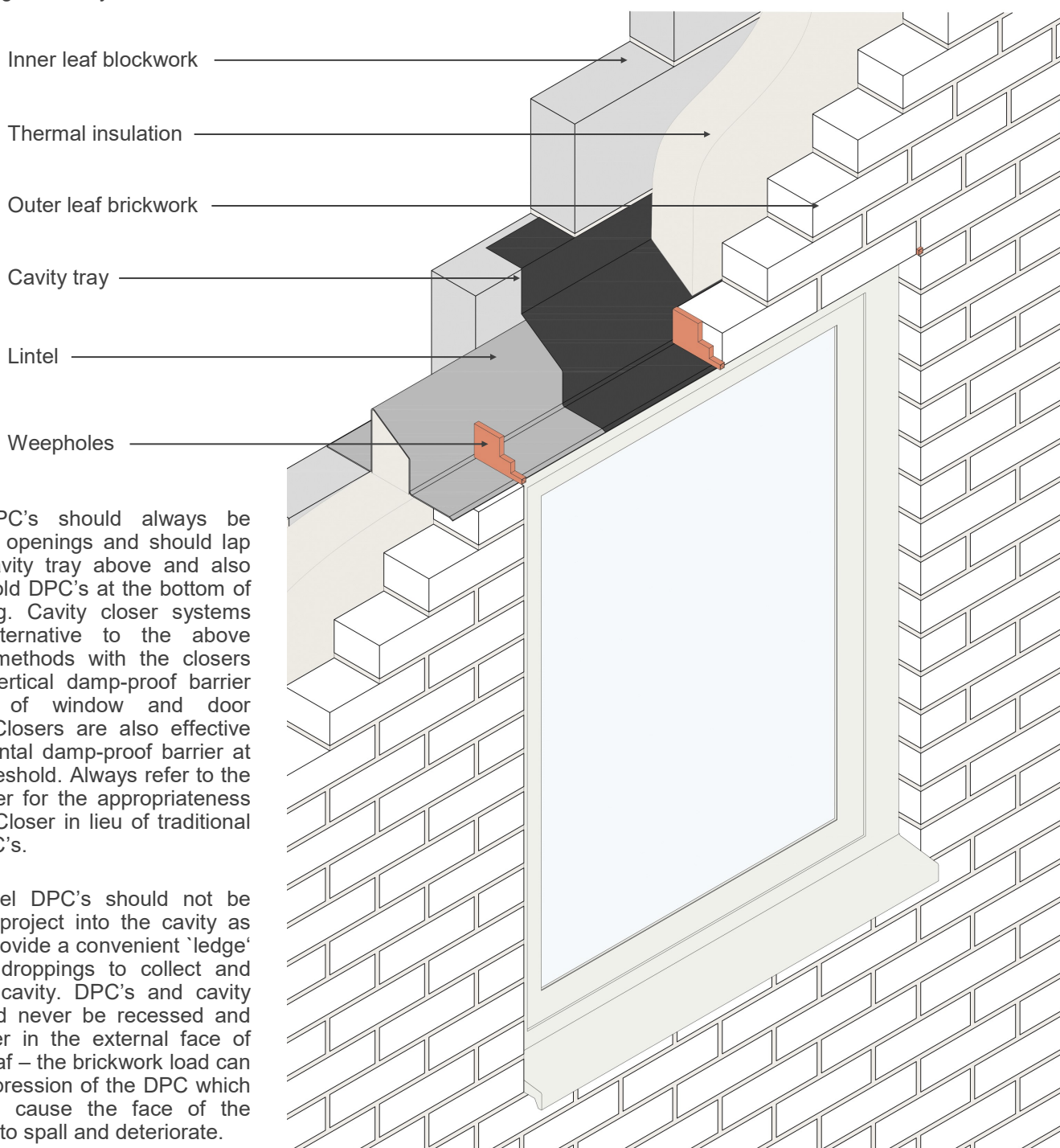

Wall tie level (or sloping down to outer leaf)

Wall tie sloping towards inner leaf

WORKMANSHIP
(CONTINUED)

It is essential that cavity trays, damp proof courses (DPC's) and weepholes are built in correctly and as instructed by the designer and manufacturer. The purpose of a cavity tray is to drain rainwater that has entered the cavity to the outside via weepholes. They should be provided over elements that bridge the cavity, such as lintels and meter boxes.

It is recommended to use pre-formed cavity trays. Whilst initially they may appear more expensive than forming one from sheet damp proof materials on site, if they are poorly constructed it can be very costly to remediate should a problem occur post-completion of the build. Stop ends must always be provided to bond to the cavity tray, to prevent rainwater running into the cavity. Again, preformed stop ends are recommended.

Weepholes should be provided to allow the collected water to drain outside. These should be provided to at least two per opening (ie. over a door or window) at a maximum of 450mm between weep holes. They can be left open (ie. a perp joint which is not mortared), however many designers prefer to provide proprietary plastic vents that prevent insects and debris from entering the cavity.



Vertical DPC's should always be provided at openings and should lap with the cavity tray above and also with threshold DPC's at the bottom of the opening. Cavity closer systems are an alternative to the above traditional methods with the closers providing vertical damp-proof barrier at jambs of window and door openings. Closers are also effective as a horizontal damp-proof barrier at the cill/ threshold. Always refer to the manufacturer for the appropriateness of using a Closer in lieu of traditional vertical DPC's.

Ground level DPC's should not be allowed to project into the cavity as they may provide a convenient 'ledge' for mortar droppings to collect and bridge the cavity. DPC's and cavity trays should never be recessed and pointed over in the external face of the outer leaf – the brickwork load can cause compression of the DPC which in turn will cause the face of the mortar joint to spall and deteriorate.

Typical axonometric window head detail