FREESTANDING BRICK WALLS

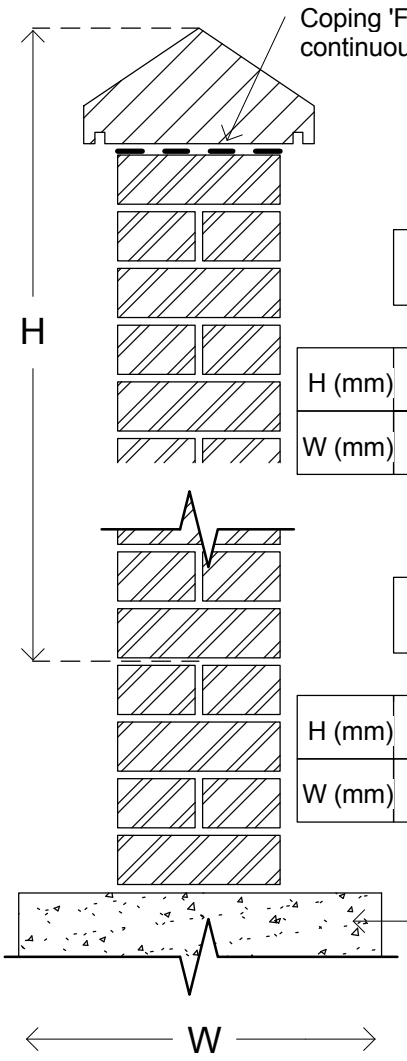
Freestanding external walls form an integral part of our hard landscaping features throughout public spaces, commercial, and residential developments. The difference in scale and form varies immensely from simple, low level boundary walls built to basic 'rule of thumb' tradition, to more elaborate walls of different plan forms requiring detailed structural calculation; in all cases, the selection of bricks should consider the durability of the product in relation to the exposure of the site, and protection provided by coping or capping features.

This Guidance Note outlines general aspects to consider in the specification and detailing of clay brick external walls.

Overall Design

The bearing capacity and ground conditions may need to be considered in certain locations, but for most typical garden and boundary walls, the width of the (concrete) foundation and height of the wall above ground level should follow simple guidelines as below.

Although brick walls are inherently strong and robust, there is a limit of slenderness for thinner wall sections which needs to be considered in relation to lateral forces and stability.
This can be overcome by increasing the wall thickness at the base or lower levels, or by increasing the 'effective' thickness with projecting piers or with a 'zigzag' or staggered plan form.



215mm Sheltered Areas

	ZONE 1	ZONE 2	ZONE 3	ZONE 4
H (mm)	1925	1750	1600	1450
W (mm)	525	550	575	575

Exposed Areas

	ZONE 1	ZONE 2	ZONE 3	ZONE 4
H (mm)	1450	1300	1175	1075
W (mm)	600	625	650	650

F2 bricks preferred throughout but 'F1' acceptable in more sheltered locations with suitable protection

Historically, a freestanding wall would be built with a proportion of bricks laid crossways for bonding, resulting in familiar patterns of 'stretcher' and 'header' faces; this is still very much an acceptable method of construction, providing an attractive appearance, and avoiding the necessity of wall ties between two separate leaves of 'stretcher' bond.

With some bricks, the stretchers and headers may vary in colour naturally, as a result of the setting pattern of bricks in firing, but contrasting brick types also feature in both traditional and new construction to accentuate decorative forms to good effect; where stability is provided through piers or in combination with plinths, the inset panels offer an opportunity for a variety of individual design patterns, and repetitive or linear forms in longer walls.

References relating to this Freestanding Brick Walls literature:

(1) Sulphate attack A chemical reaction of soluble sulphates from the ground, or certain brick types, with constituents of cement causing expansion and damage to mortar

(2) BS EN 771-1 : 2011 Specification for masonry units – Part 1 : Clay masonry units

(3) BDA Guidance Note 'Copings and Cappings'

(4) BDA Guidance Note 'Brick Retaining Walls'

(5) BSI PD 6697 : 2010 Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2

(6) BS 4729 : 2005 Clay bricks of special shapes and sizes

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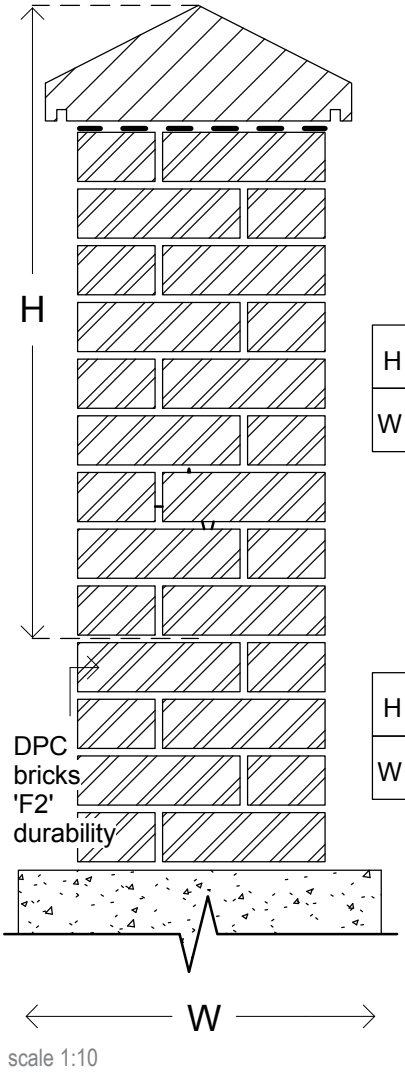

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327mm
Sheltered Areas

	ZONE 1	ZONE 2	ZONE 3	ZONE 4
H (mm)	2500	2500	2500	2450
W (mm)	525	575	650	725

Exposed Areas

	ZONE 1	ZONE 2	ZONE 3	ZONE 4
H (mm)	2400	2175	2000	1825
W (mm)	725	775	800	850

UK Wind Exposure Zones 1 to 4
(based on wind distribution)

Sheltered and Exposed Areas relate to local conditions, e.g. urban and open rural

Durability

It is important that the bricks chosen for external walls are of suitable durability to provide long term resistance to the effects of weathering and exposure, including frost and sulphate attack(1). The product Standard BS EN 771-1 : 2011(2) requires manufacturers to classify products in relation to exposure categories, and designation 'F2' is considered most suitable for detailing, particularly in locations of severe exposure.

An appropriately detailed protective coping should be provided. (Another Guidance Note (3) is available which illustrates cappings and copings).

It should also be recognised that the water absorption characteristic of a brick is related to the method of manufacturing, and is not a direct influence on the durability performance. A brick of 'F2' designation can be used throughout the wall, but where a more 'rustic' brick (of high water absorption) is selected, specifiers often consider a contrasting brick of smooth appearance and low water absorption for capping elements and for the base courses; set in a strong mortar, this can assist in avoiding longer term staining of brick surfaces and mortar joints, and avoids the requirement for a horizontal damp proof course at low level, which would weaken the stability of the wall if installed incorrectly.

In many residential developments, the ground level to either side of garden walls may vary, and this may require inclusion of a membrane to prevent water (and ground salt) migration from the higher level, although specific reference to detailing of 'retaining walls' is made in another Guidance Note (4).

Where paving is the finished surface to either side, this should be laid to falls away from the wall where possible, or provision made for a drainage strip to prevent unnecessary saturation of the lower courses.

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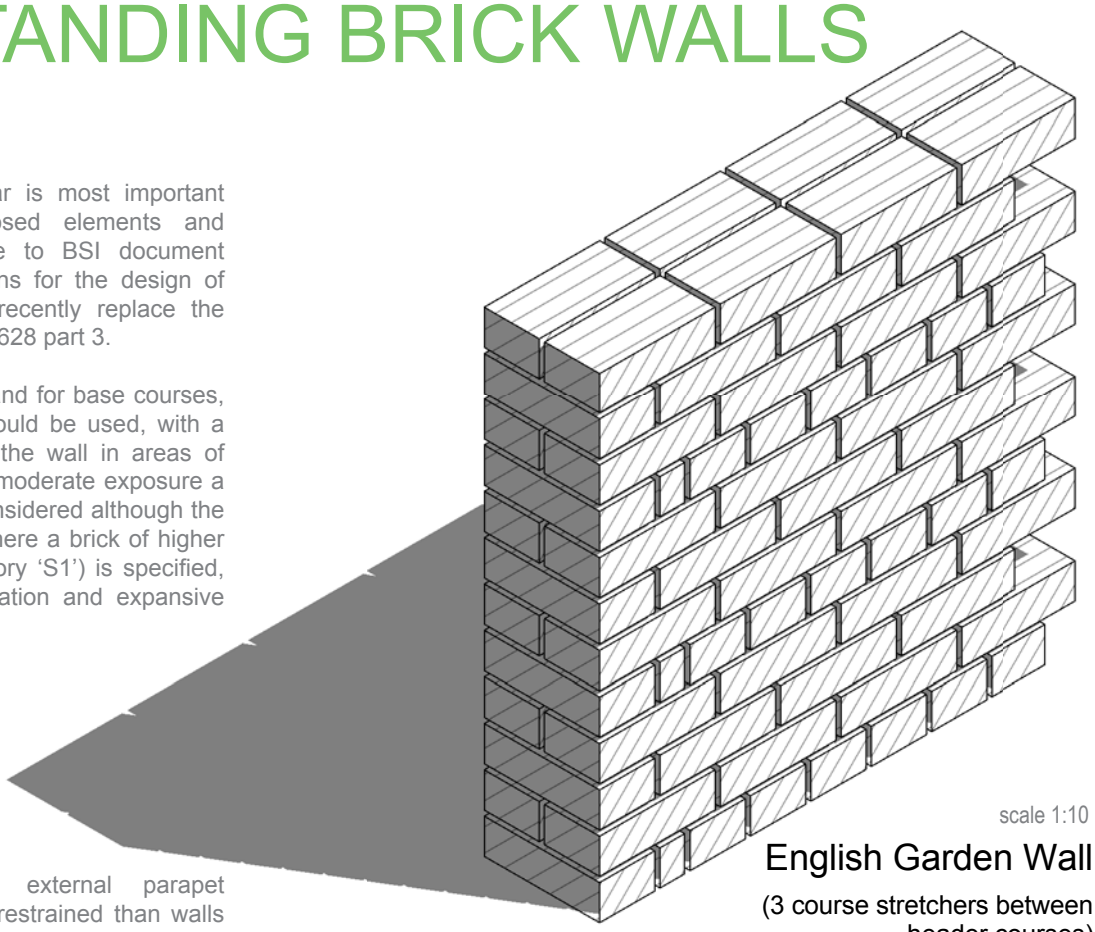
Mortar

The durability of the mortar is most important especially for more exposed elements and reference should be made to BSI document PD6697(5) Recommendations for the design of masonry structures which recently replace the former code of practice BS 5628 part 3.

For copings and cappings, and for base courses, a category ‘M12’ mortar should be used, with a similar strength throughout the wall in areas of severe exposure. For more moderate exposure a class ‘M6’ or ‘M4’ can be considered although the latter should not be used where a brick of higher soluble salts content (category ‘S1’) is specified, to avoid potential salt migration and expansive reaction with the mortar (1).



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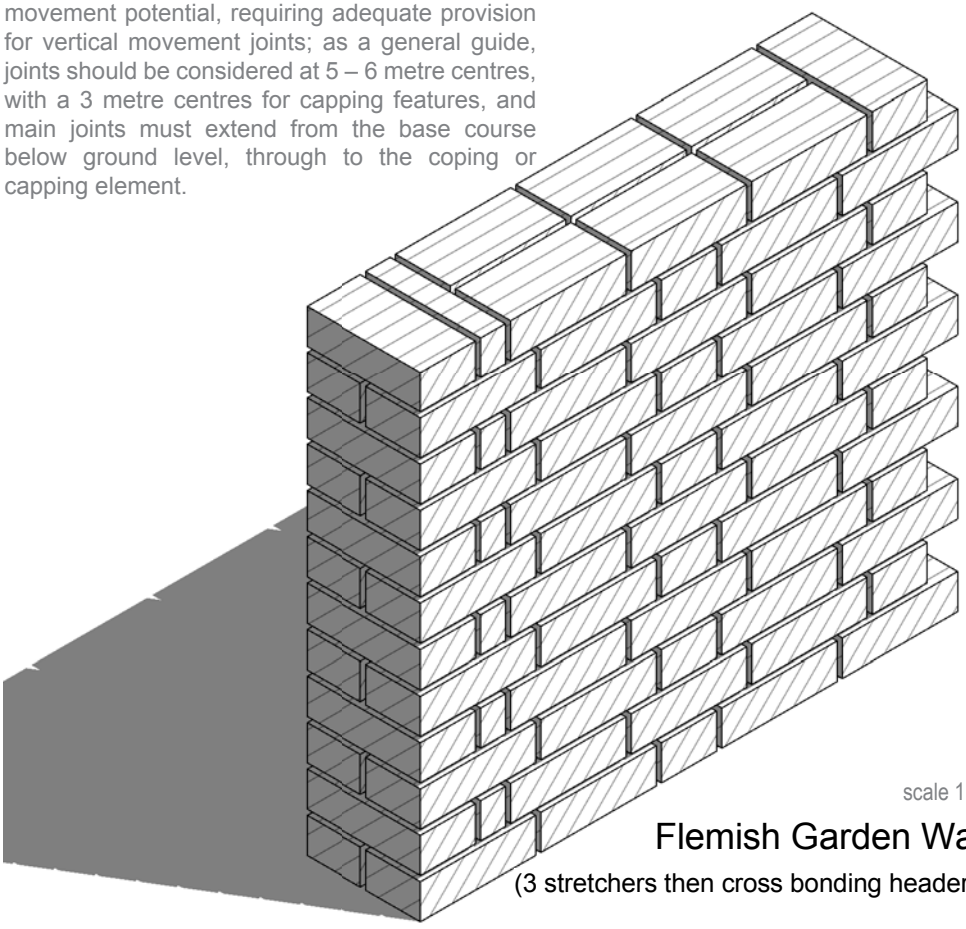
English Garden Wall

(3 course stretchers between header courses)

Movement joints

Freestanding walls (and external parapet conditions) tend to be less restrained than walls of buildings, and are subjected to more horizontal movement potential, requiring adequate provision for vertical movement joints; as a general guide, joints should be considered at 5 – 6 metre centres, with a 3 metre centres for capping features, and main joints must extend from the base course below ground level, through to the coping or capping element.



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Flemish Garden Wall

(3 stretchers then cross bonding headers)

It is important to select a compressible joint filling material, and proprietary products are readily available; fibreboard and cork based materials are not suitable however, particularly when wet, as this significantly reduces the already limited compaction. Gun applied sealants can provide an attractive finish to the joint, with a range of colours to match or contrast with the brick finish.

The practice of leaving a small (10mm) gap between linear walls may achieve a suitable separation in some cases, but can easily result in mortar blocking the space becoming ineffective, with issues of continuity through the coping or capping.

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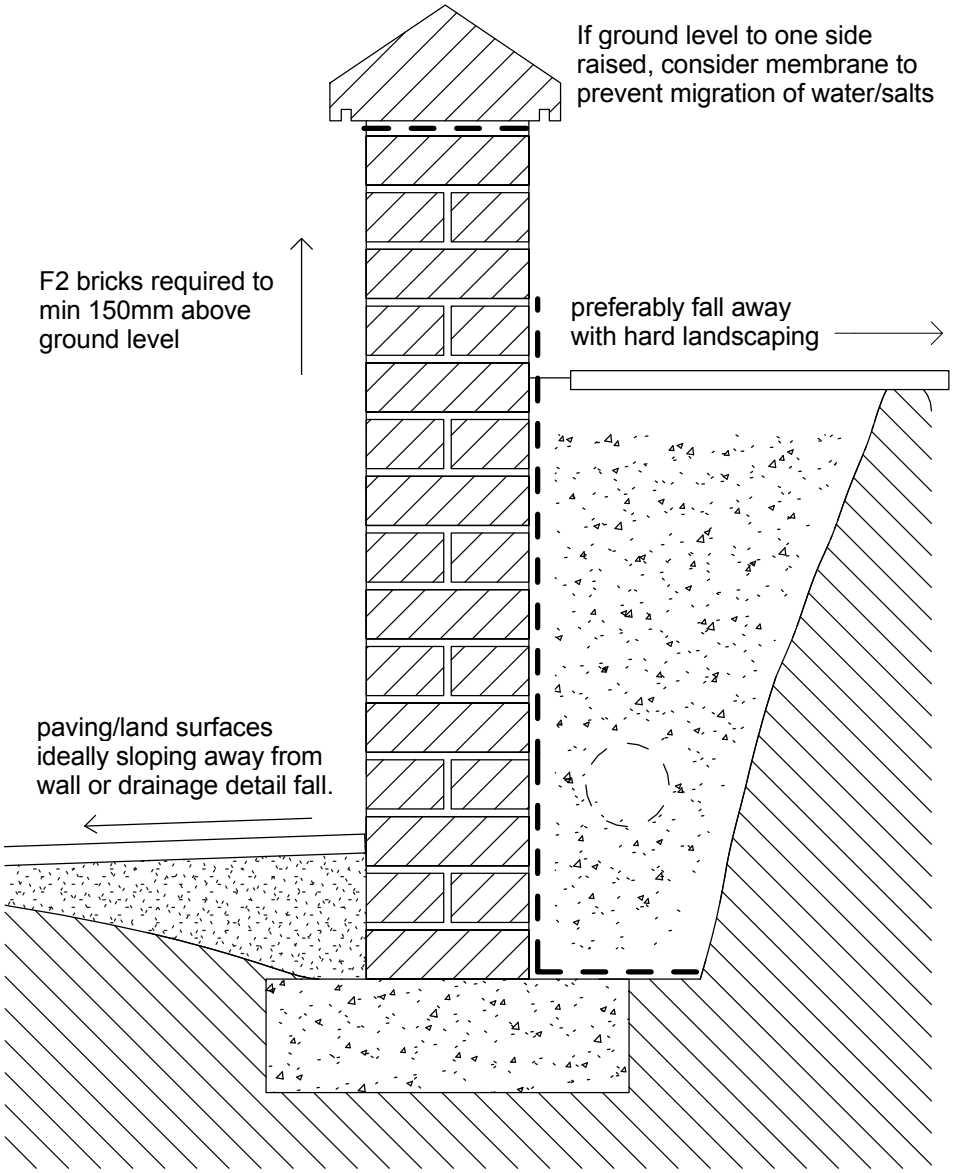
Wall Features

The simplest form of freestanding wall is of linear design with a consistent number of courses throughout, finished with a capping or coping in a horizontal plane. With sloping sites, this may result in a series of stepped sections, requiring a special end detail for the coping element; even with a basic brick on edge capping, solid units (preferably faced on bed) should be specified, or larger blocks with faced sides.

Where access is required, a common feature at each end of the break in the wall is a column or pier, providing a suitable fixing for a gated entrance. The height of the brick wall may provide enclosure, but in many residential areas the boundary wall may comprise a series of intermediate piers projecting upwardly from a lower wall, providing support for metal railings or timber screen panels in-between. The fixings should take into account the potential characteristic (differential) movement through weather cycles, but also with timber fencing, resistance to wind pressure, causing a local stressing of the brick pier; brickwork should therefore be of good quality with a strong mortar and completely filled mortar joints.

Both metal railings and particularly timber panels require periodic maintenance, and observations of the latter highlight the run-off of water and detritus causing a local saturation and staining of capping features and brickwork below.



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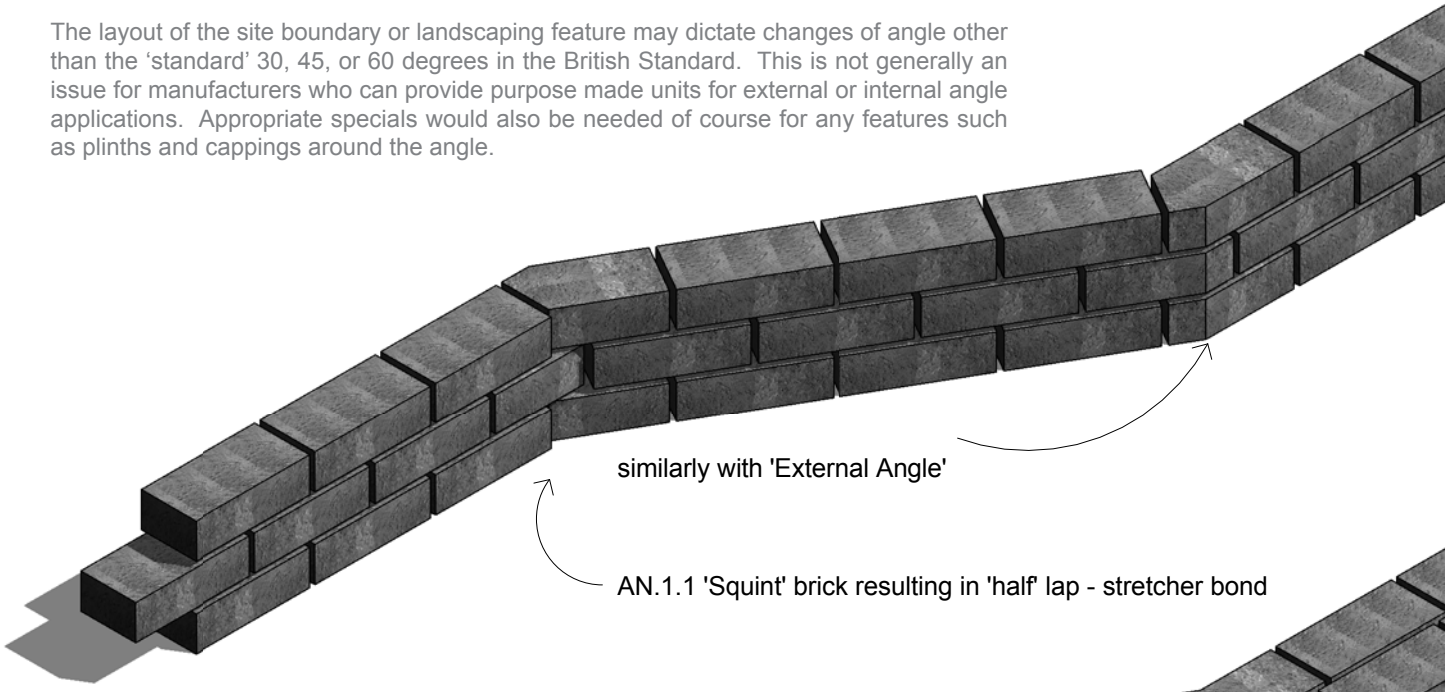
FREESTANDING BRICK WALLS

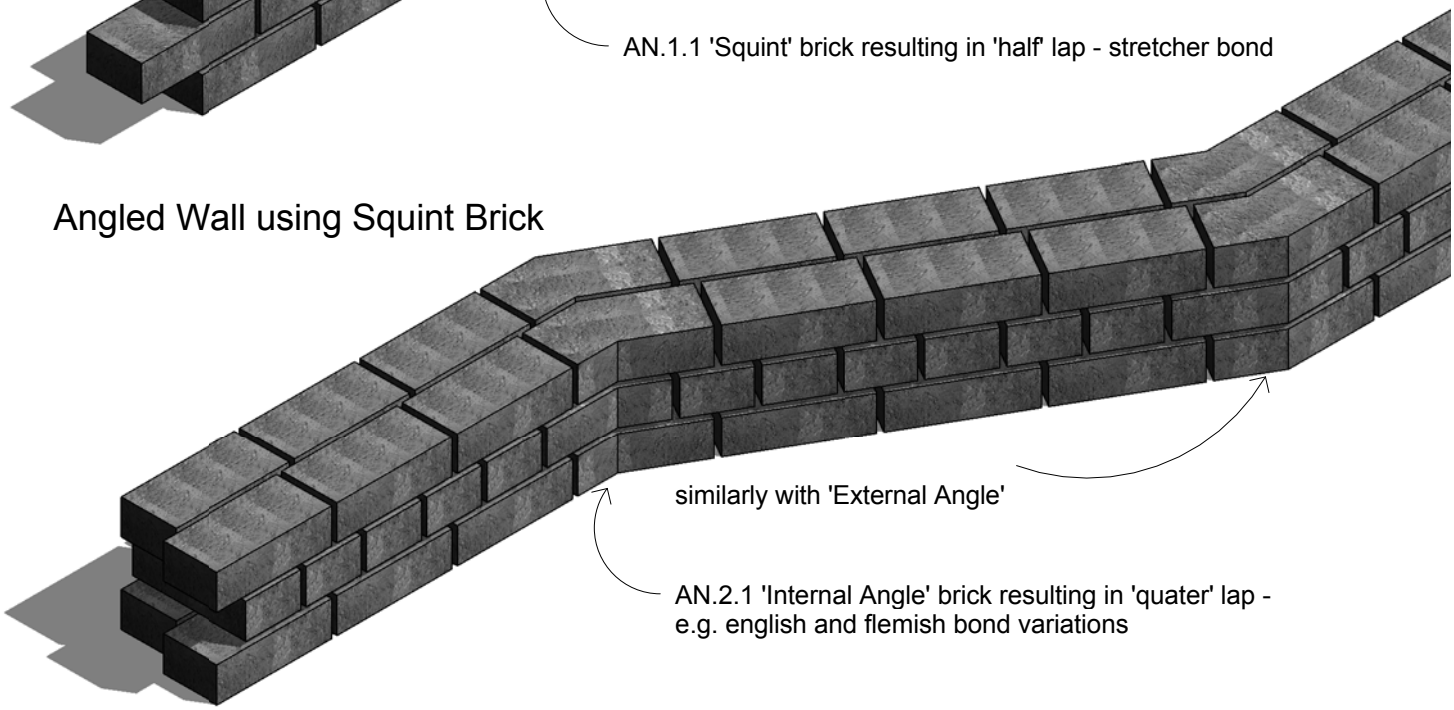
Angled Walls

At changes of direction in plan, external and internal shaped angles should be incorporated to avoid the unsightly appearance of standard bricks overlapping; the British Standard for units of special shapes(6) includes a range of angled bricks developed to take into account the dimensions of bonding bricks – historically with cross bonding, resulting in ‘quarter’ bond, or the simple ‘squint’ brick which allows stretcher bond to continue around the angle.

The layout of the site boundary or landscaping feature may dictate changes of angle other than the ‘standard’ 30, 45, or 60 degrees in the British Standard. This is not generally an issue for manufacturers who can provide purpose made units for external or internal angle applications. Appropriate specials would also be needed of course for any features such as plinths and cappings around the angle.



Angled Wall using Squint Brick



Angled Wall using External Angle Brick

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An alternative to ‘manufactured’ specials is the fabrication, or cutting and bonding, of standard bricks to form specific angles. The technique can be successful avoiding mould or die costs in production, but should be carried out in controlled conditions within a suitable environment, and good quality control is essential.

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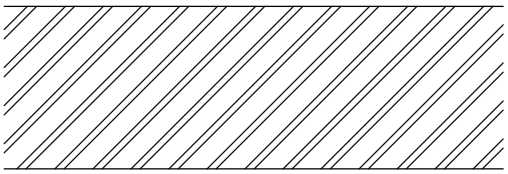
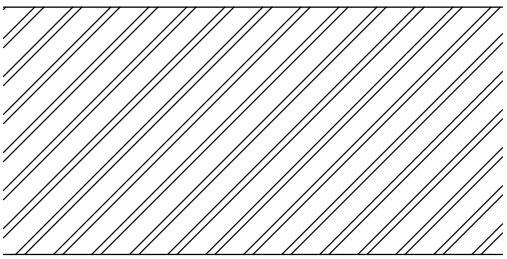
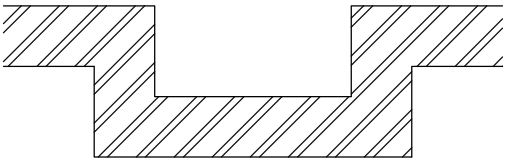
Brick Wall Profiles



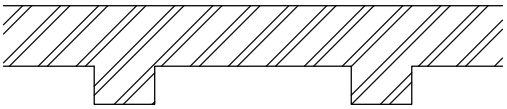
215mm 'conventional' walls



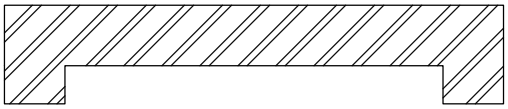
327mm 'conventional' walls



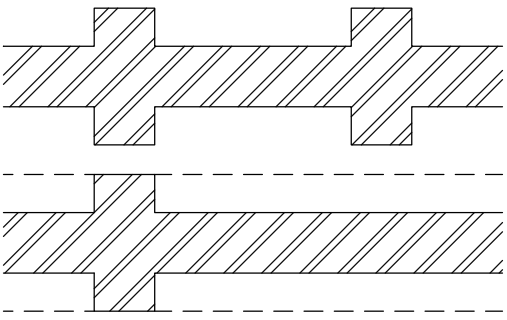
staggered profile, beware unfaced sides with some brick types (particularly wirecut/extruded)



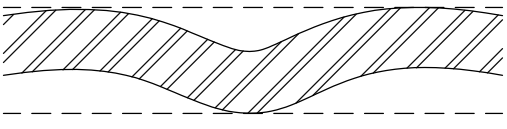
effective thickness increased by piers



stability achieved with columns/piers at either end



option for additional stability with piers to both sides and plinth detail to one or both sides



curve on plan to increase effective thickness

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Wall Features

In more open developments, continuous metal railings may be provided for decorative or safety reasons over lower freestanding walls. Clearly a sound fixing is required, but this should not be rigid enough to create stressing of the bricks locally, particularly if fixed directly to a brick on edge capping, and for longer sections (allowing for differential movement between metal railings and brickwork support) a series of balusters and detailed joints is recommended rather than continuously welded sections.

A brick of low water absorption set in a strong mortar is preferable to a horizontal membrane dpc in the base courses. It is advisable however to include a dpc sandwiched in mortar immediately below the coping or capping, to prevent the downward movement of water (through mortar joints). Where a more robust detail is preferred, particularly in areas of public contact or vandalism, it is accepted practice to include the dpc at a lower level but within the upper courses.

Traditionally built walls may incorporate a tile creasing which can assist in projecting water away from courses below, but a membrane dpc is still recommended for a more resistant detail.

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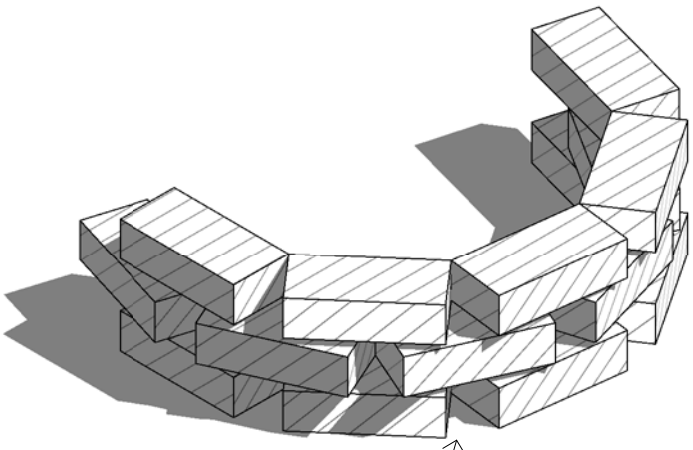
Curved Walls



Curve can also be limited to taper of mortar joint with standard facings

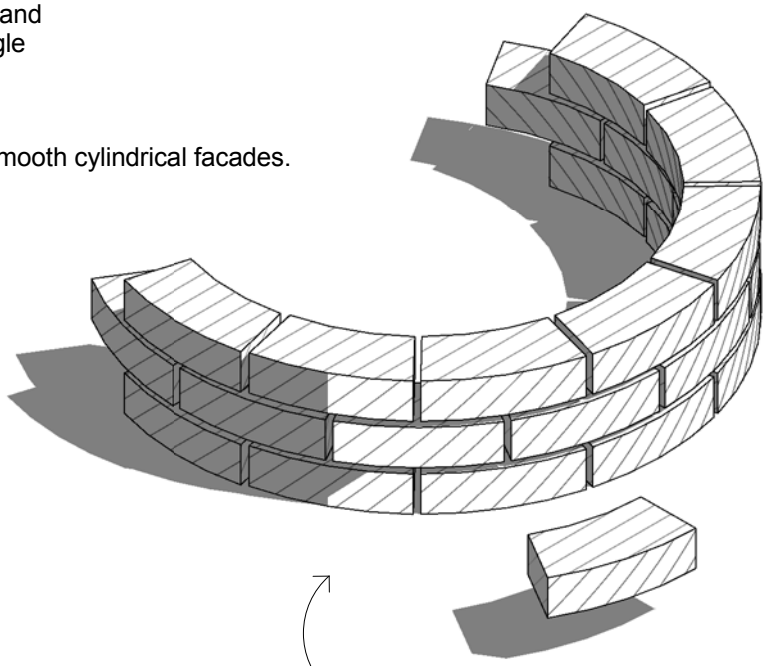
Freestanding walls may also be curved on plan to follow site boundaries or to provide effective thickness in a 'serpentine' form of gentle radius. Although the British Standard for special shapes includes a range of 'radial stretchers' these are of convex faces and only suitable therefore for external curves – applicable mainly for the outer leaf of buildings. It is possible to use standard bricks however to form a general curve, and with stretcher bond a threshold radius of 4 metres provides a curve without unsightly overlap in alternate courses. (With bricks of characteristic irregular arrises such as handmade units, the threshold can be reduced to 3.5 metres).

Adopting header bond will also achieve a reduced curve, by creating more facets; in a full brick width wall and cross bonded, this will be limited by the acceptable tapering of mortar joints visually, on both sides of the wall. It should also be remembered that the 'header' faces may not be of the same colouring as adjacent sections of stretcher brickwork, and with an increase in the mortar proportion, the curved element may stand out.

Where tighter radii are required, this may involve purpose made specials, of both convex and concave profile.

With obtuse angles an unsightly overlap will occur and will therefore be unsuitable. Only with an acute angle and smaller radii can a standard brick be used.

Radial Bricks are preferable as they can perform smooth cylindrical facades.

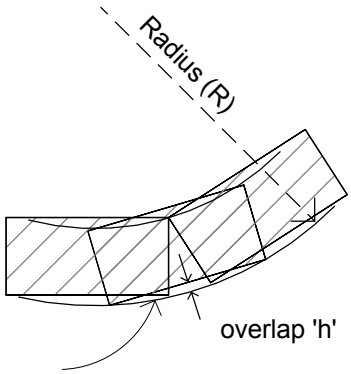


RD. 2 Radial Stretcher 'convex'

Convex Facing Bricks are used for 'external' conditions.

Concave Facing Bricks are required for 'internal' conditions.

These come with either a straight or radiated back face



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Brick face = line of chord (L)

Guidance for half lap/stretcher bond min. radius 3.5 to 4.0 metres
Tighter radius with header bond but determined by acceptable taper of mortar joints.

For Caluclation:

overlap $h = R - \sqrt{R2 - (0.5L)2}$

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