

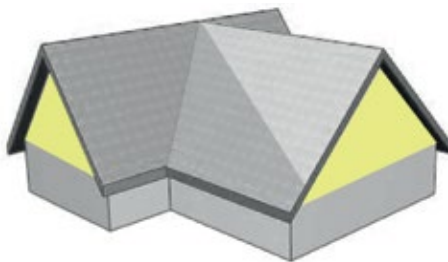
GABLE WALL ISSUES



By Mark Doyle

While newer gable walls rarely have problems, older gable walls do and can be notoriously unpredictable. In theory, their construction should be straightforward. They are generally not designed to be structural or load bearing and usually comprise the same materials and techniques as the rest of the property. However, gable walls are larger, more complex, more exposed and are more susceptible to the vagaries of recent improvement works than other walls in a property. Not surprisingly, issues with gable walls tend to revolve around two things: the construction methods employed and how these walls have been looked after.

A **gable wall** (or 'Pine End in Wales'), is usually the end of a building, but the 'gable' specifically is the triangular portion of a wall between the edges of intersecting roof pitches. The shape of the gable wall itself, the construction methods used, and the materials can vary greatly.



These walls can be large (even twice the size in area of the front and rear walls), so not surprisingly, they are also known for catching the weather! It should be no surprise that gable walls are not suitable structures for areas with high winds or hurricanes.

Throughout the UK, gable walls are typically thought of as damp, wet and can even be cold to the touch inside. More modern properties would have a gable wall constructed with a true cavity, typically with an inner course of block or even lightweight SIPs, a layer of 50mm cavity insulation or more and all tied to an outer-facing brick course. A feature gable wall may even carry no load whatsoever from the roof, and does little or nothing to support the adjacent wall. Such gable walls can be made from glass in an aluminium frame, incorporate SIPs panels or even lightweight zinc panels, all held together with gunned nails, screws and sealant. Today the limits of design and utilisation are only dependent on the architect's vision and engineering skill.

To an architect, a wall is a structural element used to divide or enclose and, in building construction, to form the periphery of a room or a building. It can be utilised in the design, load dependant!

Gable Wall construction

Although the gable wall or gable end would have utilised the same materials as the rest of a property's construction, many of these walls are regarded as infills or even as stop ends. They rarely comprise the front of a property, are usually perpendicular to the main roof construction and are often hidden from view down a passage, against a neighbour or facing a side road. Hence the main load bearing walls tend to be the cavity walls at the front and rear of the property. The gable wall may even be a solid single-course wall, supporting only a small part of the load carried by the ridge beam, purlins, rafters and the ends of the wall plates.

In a cavity wall, usually the brick courses are feathered in correctly. But, some bricklayers can take liberties with the outside course of brick on a gable wall, especially if an outrigger has been added. They may have constructed, repaired or re-built them, tied in, in groups of five or six courses at a time.

Gable walls cut across one side of the internal rooms are often suitable to carry the chimney stack and give access to the ground floor and upper floor rooms with multiple flues. In which case, the inner-brick course may well form part of the chimney itself, and the full height of the chimney stack can then extend above the wall and roof level.

Wall Issues

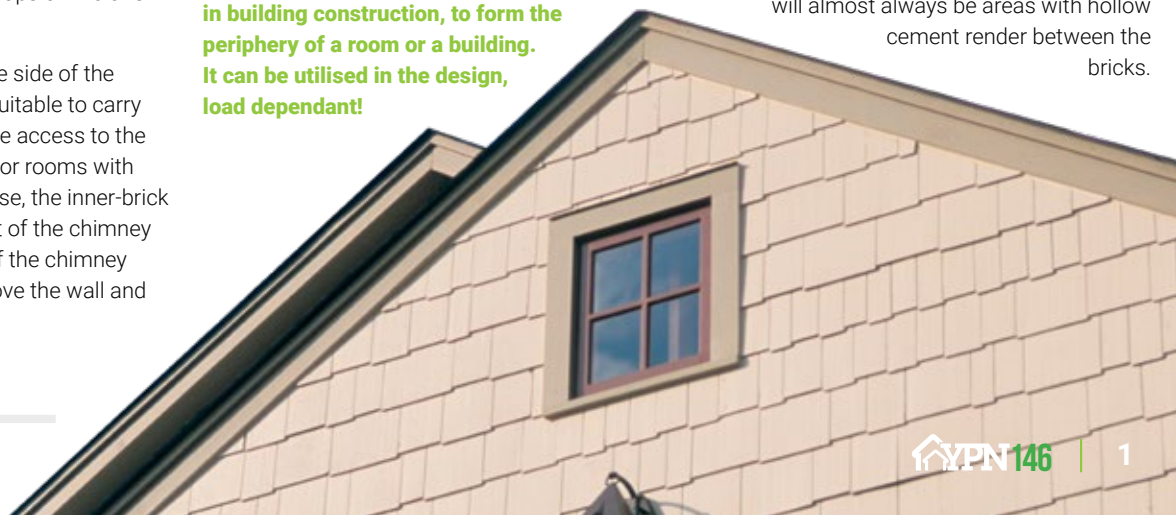
Air bricks and the DP course: If the air bricks in the wall are blocked or filled with sealant, the wall will retain moisture and not dry out as quickly. A damp bridge can be created where soil, fill material, pavements, concrete or tarmac abut against the wall and rise close to or above the DPC.

Chimney stack leaning: Chimney stacks were often built up the inside of a gable wall, usually feeding chimneys into two ground floor rooms and two first-floor rooms (although they may contain more flues to basement or second floors, etc). In a typical two-bedroom terraced house these chimneys could have a stack on the roof, ranging from a small 60cm structure up to a two-metre high, two-tonne brick structure. If for any reason the structural support fails below the exposed stack, they will start to lean over and in time, these will collapse.

Floor to gable wall separation: When examining the floor adjacent to a gable wall, sometimes a clear gap or larger than expected space can be seen between the floorboards and wall. Signs of movement may be obvious on the floorboards showing where the skirting boards originally sat but have now been displaced.

It's also worth bearing in mind that the floor joists usually run parallel to a gable wall and are rarely tied into the structure. However, where chimneys are present, shorter lengths of floor joists usually run at a right angle to tie into the gable wall. In either case, large gaps may exist, which signal movement is taking place.

Horizontal cracking: Sometimes areas of wall with horizontal cracks can be seen in the mortar beds of gable walls between brick courses. During and after periods of heavy rain, these cracks may leak rainwater down the outside of the wall. These areas of wall will almost always be areas with hollow cement render between the bricks.



Gable Wall Symptoms

A gable wall with issues will usually exhibit a range of symptoms, which when put together, show a bigger picture. As with most structural problems, not all issues with gable walls are visible, but several minor issues can build up and in time be catastrophic for the wall. However, most issues do give tell-tale indicators as shown in italics shown on the right.



Photo 1:
Gable wall cavity holding water



Photo 2:
Chimney stack leaning



Photo 3:
Internal wall cracking

Infilled cavities: Material does fall into the cavity of walls during construction and can get washed in if there are cracks and leaks. These areas of infill can show up externally, particularly after prolonged wet periods and storms, as large damp shapes visible in the mortar layer on the wall. There is also considerable momentum building that the addition of Thermabeed insulation to some wall cavities not suited for insulation (ie thin cavities less than 50mm wide). Although thought to be free draining, water can also be retained in wall cavities.

Internal wall cracking: Internal walls perpendicular to a gable wall are usually tied into it to support its structure. However, should these walls lose support on one side, they will crack (usually at roughly a 45 degree angle following the line of weakness through the wall's mortar beds). These cracks may be obvious, but equally they may only be visible as a shear-type pattern in wallpaper and plaster.

Lintel or sill movement, twist and separation: A lintel over a window or a sill below a window may lead to one side, twist, rotate and gaps may appear around its edge. Again, this shows some movement taking place. Often these lines of disturbance can be followed across a building from doorway to window to window and so on.

Roof: The roof construction may cause issues, particularly if the gable wall rises above the roof and is then capped off, or if the ridge tiles are fitted incorrectly or pointed badly, is shallow or has narrow valleys. So even a good quality Welsh slate roof may have lead-lined stone gutters that sit on a cavity wall. These may split without expansion joints or slope downward at the ends allowing water to enter the gable wall.

Sagging or bulging gable walls: A gable wall that bulges, sags, is concave, and/or convex in places is an indication of structural failure within the wall itself. It is almost impossible to do a simple repair and usually needs a re-build.



Photo 4: Floor to gable separation along the left side



Photo 5: Gaps around window, sill and lintels in gable wall showing 100mm outward bulge.

Surface feature failure: Most gable walls have barge boards, soffits, rainwater goods and flashing fitted, any of which can break or crack and split. Any sign of disturbance may simply be poor workmanship or the effects of time, but they may also be linked to movement in the wall. Obviously cracked or broken rainwater goods will allow water to run over the wall.

Tar and bitumen staining: Older properties with chimney stacks against their gable walls often show a trace on the outside of the wall where the tar from burning coal in fires over many years has started to penetrate the wall itself. This baking process and chemical penetration can weaken the cement render between bricks and can even make some bricks brittle in nature.

Wall covering cracking: This is particularly obvious when a uniform surface material such as a cement render or K-rend has been applied, however it can be more difficult to see with pebbledash on a concrete render. These areas of render both prevent old lime mortar from breathing. But hollow render can also crack and bulge, and can hold water against the main gable wall brickwork, which will in turn retain moisture and become almost spongy in nature.

The various wall issues observed on site can be mapped out in 3D on a drawing, building plan or even across photos. When seen together, it will highlight what's happening across a wall or perhaps a whole building. Depending on the scale of issues and movements involved, a building surveyor or structural engineer can place monitoring points over the structure, and these can be surveyed to monitor and record actual movements. Based on this collective information, remediation works can be planned to deal with each issue in turn, unless of course it's simply obvious that the entire wall needs re-building.

Wall Remediation

The extent of remediation works is dependent on the damage and whether a wall can be saved. Any minor repairs involving rainwater goods, removing the cause of water ingress or a cold bridge can be dealt with quickly by a contractor or handy-man. Even flashing repairs and re-pointing a chimney and gable wall are relatively straightforward tasks for a tradesman.



Photo 6: Solid 9" wall with crumbling mortar in poor condition

Building damage like cracks with no obvious signs of settlement/subsidence and open joints between walls can be repaired, although specialist contractors or an experienced bricklayer would be required. Various techniques can be used to save these walls, such as strengthening corners and joints with metal straps, inserting helical bars across cracks embedded in the mortar, replacing old timber or smaller lintels with newer concrete or Catnic box lintels on pad-stones, and re-bricking up of larger joints and gaps in brickwork.

It's common to see in a recommendation for remedial cavity wall ties be undertaken by the owner prior to sale in mortgage valuation reports on older properties. This is usual for properties, say pre-1930s, where surveyors suspect the wall ties have deteriorated to the point that they no longer provide any support across the cavity.

Gable wall removal and re-build

It all becomes more serious when a gable wall noticeably bulges or sags, therefore showing failure of the cavity ties, and exhibiting several tell tales of movement all at the same time. At this point, it is obviously beyond repair and is heading towards collapse. To grossly oversimplify, the wall will need scaffolding, the internal floors/ceilings/roof supporting with timber, Acros and strong boys, and probably the internal walls bracing. You may even need to erect temporary walls internally to strengthen, provide security and protect from adverse weather. Then the wall can be taken down, brick by brick.

“As you take a wall down, you can learn exactly what the true cavity spacing is, how many wall ties there are and what state they're in.”

You'll see what's in the cavity, how strong the mortar is or how loose the bricks are, and so on. If there are any masonry lintels or steel beams and you're planning to reuse them, you'll see what condition they're in and you can ensure you have sufficient space for any new padstones specified by your structural engineer.

Sometimes, when a wall is coming down it becomes obvious that you can't do what you originally wanted as the existing wall structure is different than expected. In cases like this, you may need the urgent support of your structural engineer and building inspector to review and, if necessary, re-design structural support.

A real example would be a proposed single 4.2m long steel I-beam that was suddenly found to be inadequate on a project. A quick re-design required two new overlapping 4.5m steel I-beams on much larger padstones. These needed a larger crane to lift onto the scaffolding, which in turn needed additional re-enforcing. This caused a delay of a week, and delays cost money. However, issues do arise all the time on projects and they can be dealt with.

Can anyone sort out a serious structural issue?

Yes, anyone can sort out a serious building defect, but we all need help and that's what the professionals are for. Make sure you get good advice from your structural engineer, building surveyor and building inspector. All these works can be costed in detail based on what you know at that point in time. We would however, always advise allowing a larger contingency. As a rule of thumb, the older the wall, the bigger the contingency, even up to 50%.

Case Study

A large Gable Wall with 2 hanging chimneys

PRESTON, LANCASHIRE



Photo 7: Gable Wall original condition



Photo 8: Scaffolding in place

This building is a 4 story Edwardian terrace of 4 buildings, with a large gable wall containing 2 large chimney breasts and several windows in poor condition. This wall was sagging outward by 100mm and the 2 large chimney stacks on the roof were leaning dangerously over the main roof (see photo 2 & 5 above). Other observations included, sloping floors, internal floor to wall separation (see photo 4), cracking of perpendicular walls (see photo 3), movement of windowsills, horizontal cracking in mortar beds and deterioration of mortar.



Photo 9: Visible chimney flues & solid 9 inch wall



Photo 10: New cavity wall, internal dense block, insulation, wall ties & facing brick

The situation was compounded when it was realised that the chimney breasts had been removed at lower ground & ground floor levels to open a double fronted shop. These works had included the installation of a large steel box in the ground floor ceilings to support the building. But this had left the 2 chimneys and approximately 40 tonnes of brickwork hanging off a 100mm/4" steel

beam that had been run under the chimneys in the ceiling of the ground floor. Not surprisingly gravity was acting on the wall which was slowly moving downward (hence the bulge).

Due to the size of the gable wall a 5/6 lift scaffolding platform was erected and the chimney stacks and both courses of brick wall were carefully removed brick by brick from the structure. The wall was rebuilt over a period of 4 months due to poor weather delays and additional structural issues. All the works in connection with the Gable wall cost £20,000.



Photo 11:
New Catnic lintels over windows



Photo 12:
New wall topped out & completed!

CONTACT

Mark is happy to chat with anyone that may need some assistance and can be contacted on **07973 971530** and at **mcdoyle39@gmail.com**