

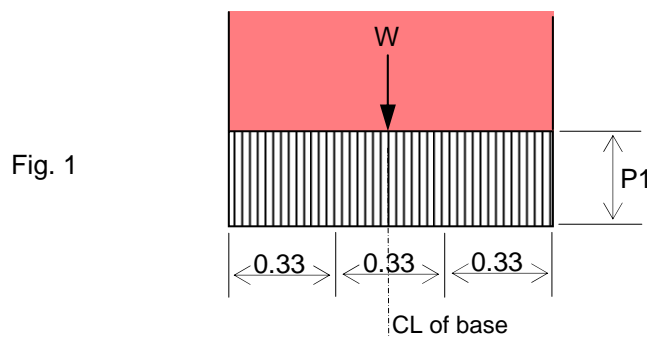
Introduction

Freestanding Boundary and Garden Walls of masonry construction, over a period of time may show signs of considerable lean and bowing. The difficulty then is how to establish whether the amount of movement shown is acceptable and that the wall is not on the point of collapse.

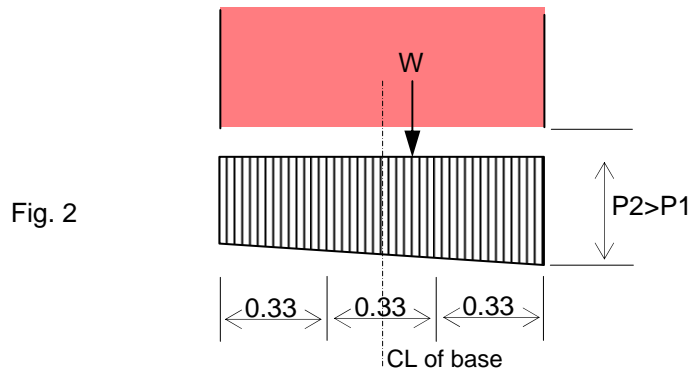
Theoretical Base Pressures

There are no negative pressures under the base of a free standing wall no matter how much it has rotated about its base. Three distinct pressure states can occur dependant upon the amount of rotation experienced

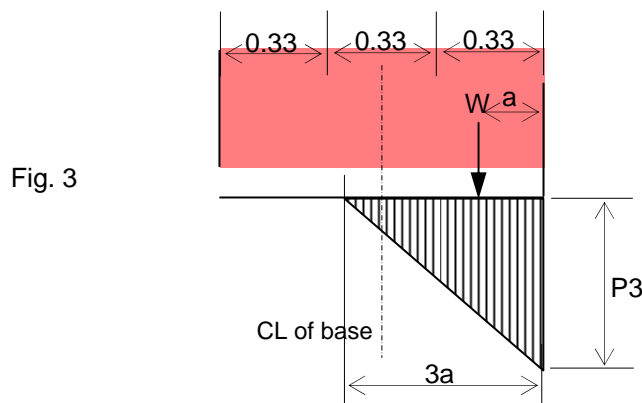
1. When the wall is perfectly vertical and its centre of gravity (CG) passes through the centre of its base then the pressure diagram under the base is rectangular



2. When rotation has occurred that causes a vertical line through the CG of the wall to be eccentric to the centre of its base, but still within its middle third, then the pressure diagram becomes trapezoidal



3. With further rotation such that a vertical line through the CG of the wall is eccentric to the base, to the extent that it passes on or outside of the middle third of its base then the pressure diagram is triangular and its maximum ordinate will always be greater than an ordinate on either of the rectangular or trapezoidal diagrams.



In Fig.3 it can be seen that the pressure is zero to the left of the triangular stress diagram because the soil cannot develop tension. The area of all three diagrams are the same however, as they must equate to the vertically applied load (W).

When the wall has rotated such that there is an eccentricity of half of its width (ie. CG passes through face of the wall at its base), then the overturning moment equals the restoring moment and there is no longer any factor of safety to overturning and the wall may be considered as being at the point of falling over.

Practical Considerations

It should be remembered that most walls are built off foundations that are generally wider than the wall itself and also that there is some tensile strength in the mortar that bonds them to the foundation. This will influence the action of a wall that has rotated. The fact that the wall may extend some distance below ground before reaching its founding level will also be a factor to be considered because of the resistance provided by the passive reaction of the soil.

There are really too many unknowns to make a meaningful judgement from above ground observations alone without being over conservative, especially when one considers that any 2.0m high free-standing wall requires to be at least one and a half bricks thick at its base in order to meet current wind load standards.

Even without considering walls that have rotated by even a very small amount, an existing one brick 2.0m high wall will have already experienced overstress in the brick joints at its base due to wind loading. If this overstressing has resulted in tensile cracking of the joints, then it is only the self weight of the wall that is resisting overturning due to wind loading.

Consideration based on theory generally assumes that the wall is in good condition, however walls are often found to be built poorly built and of poor condition with weak mortar joints, inadequate copings and sometimes unsuitable dpc's.

A movement of half thickness of the wall would take the CG over the corner of the base, but still the wall may not fall over due to the weight of the wall. Any additional lateral load on the wall (eg. wind, impact, etc.) may then cause the wall to collapse. This is even more likely to occur if the wall is in poor condition with weak mortar joints that have tensile cracks or where the mortar is loose or missing, effectively reducing the original width of the wall.

The use of unsuitable dpc's (eg. polythene) could provide a slip plane and not allow the development of any tensile stresses caused by overturning as it would have no bond strength with the mortar.

The height and location of the wall should also be considered when assessing whether the wall is dangerous. For instance a 1.0m high wall in an area of overgrown garden or inaccessible area might not be considered dangerous even though it may be leaning over by half of its width. Whereas a 2.0m high wall with a lean of one third of its width located adjacent to a public footpath may be considered dangerous.

Therefore every wall must be assessed not only on its lean, but also its overall condition, type of construction and location. Sometimes also, the stability of the wall cannot be justified by calculation and in those cases a risk assessment should be undertaken in conjunction with visual inspections and physical surveys.