Introduction

Freestanding Boundary and Garden Walls of masonry construction tend to be exposed to the weather and wind loading on both faces. If only a small part of wall becomes unstable, then it is possible that progressive collapse of the whole wall could result, with a risk of serious injury to people and in some cases even death. Collapse can sometimes occur without any obvious warning signs, particularly during times of high winds. It is therefore vitally important that the condition of these walls is assessed through regular inspection by competent persons.

Such walls may be either owned and the responsibility of the council or in private ownership. In some cases issues of ownership can be difficult to establish and for this reason the condition of the wall can continue to deteriorate unchecked.

It is important to recognise that these walls currently do not need to comply with the requirements of the Building Regulations. Although Council's do have powers to deal with walls that are found to be in a dangerous condition? Also walls, within 4.0m of the Highway that exceed 1.4m in height and which retain material are subject of approval by the Council's Highways department.

Factors Affecting Condition

In addition to the age, construction and exposure of the wall, other contributory factors that could lead to a collapse could include one or more of the following situations:

- alteration or change in use/ surroundings (since time of original construction)
- proximity of trees and/or extensive vegetation
- general deterioration in condition through neglect in the absence of any planned or timely maintenance
- inappropriate repair
- impact damage

Assessment of Condition

Inspection of walls to determine their structural integrity (eg. condition and stability) should be undertaken by a competent and suitably qualified professional such as a Structural Engineer.

If there is any doubt concerning the stability and safety of the wall, whereby it could be considered to pose a danger to the public, then it should first be made safe through removal of loose materials, propping and safety barriers, etc. Following this a more detailed assessment of condition should be made to determine the most appropriate action.

Visual Signs of a Problem

For guidance in relation to early warning signs, which might include cracks, lean, bow and trees in close proximity to the wall, refer to Table 1 (attached). This also provides details of suggested actions/ preventative measures for dealing with those problems most commonly encountered.

Areas of Possible Concern

<table>
<tr><th>Visible Defect/ Damage</th><th>Possible Cause</th><th>Things to Check
(incl. limits, etc.)</th><th>Suggested Remedial Measures/
Further Investigations</th></tr>
<tr><td>Height/ thickness</td><td>Wall too slender for height.

Existing height of wall extended.</td><td>The following table gives guidance on how high walls should be relative to their thickness. Further consideration may be required if the wall exceeds the recommended height or in circumstances whereby this guidance is inapplicable e.g. walls incorporating piers, or walls supporting heavy gates or retaining soil.

<table><tr><th>Wall Thickness</th><th>Maximum Height
(exposed brickwork only)</th></tr><tr><td>Half brick
(100mm)</td><td>525mm</td></tr><tr><td>One brick
(215mm)</td><td>1450mm</td></tr><tr><td>One and half
brick (325mm)</td><td>2400mm</td></tr></table></td><td>Reduce height of wall to recommended safe heights.

Introduce buttress piers.</td></tr>
<tr><td>Lean/ Bow (see Practical Guidance Sheet)

  </td><td>Exertion of lateral forces (ie. Wind or retained soil)

Rotation of shallow foundation.

Sulphate attack of mortar joints on one side of wall.

Physical contact of tree trunk against wall.

Wall too slender for height and exposure conditions.</td><td>Walls lean for a variety of reasons, due for example to failure below ground caused by tree roots, a cracked drain, frost damage to the foundations or inadequate foundations in the first place. If the wall leans to an extent that could present danger e.g. more than 30mm for a half brick wall, 70mm for a single brick wall, or 100mm for a brick-and-a-half wall further consideration may be required. This may involve checking the wall foundations.</td><td>Demolish wall and rebuild (possibly on new foundations).

Introduce buttress piers on new foundations.

Rake out defective mortar joints (due to sulphate attack) and repoint with sulphate resisting mortar.

Remove tree, introduce relieving arch over base of trunk or take down section of wall and replace with railings, etc.</td></tr>
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Brick Faces/ Pointing 	Weathering of mortar joints. Repointing using hard cement mortar resulting in brick faces spalling due to freeze/thaw action of water trapped within bricks.	Slightly recessed old pointing is not normally a problem. However, missing pointing over a wide area can weaken the structure of the wall. If the mortar can be easily scraped out this may indicate that the wall needs re-pointing. Repointing mortar should not have a higher than normal cement content as the resulting 'hard' mortar can trap moisture in the wall resulting in damage to the brickwork. If restricted to a few bricks crumbling brick faces may not be serious, but walls can be weakened by general crumbling across either face.	Rake out defective joints and re-point with lime mortar or 1:1:6 mortar. Cut out spalled bricks and re-stitch new to match existing or re-dress brick faces with proprietary repair mortar.
Local damage (eg. bricks on edge/ copings) 	Localised damage due to weathering of mortar joints. Physical damage. Vegetation growing in mortar joints.	Copings may be loose or there may be horizontal cracks (frost damage) in the brickwork a few courses. Loose or damaged masonry near the top of the wall may need to be re-built and should ideally include a damp proof course.	Rebuild/ repair defective sections of wall. Remove vegetation, repoint joints and prevent vegetation from re-attaching to brickwork.
Cracks 	Foundation movement. Heave in clay soils. Collapsed drains beneath wall. Physical force on underside of foundations from tree root growth. Physical contact of tree trunk against wall. Thermal/moisture movement together with a lack of movement joints.	Hairline cracks 0-2mm wide are common in walls and may not indicate serious problems, for wider cracks seek expert advice; some may indicate a need for partial or complete re-building. Seek advice on any horizontal cracks that pass right through a wall or any cracks close to piers or gates. Pointing of cracks can lead to problems. Do not point them without first establishing their cause.	Partial or complete rebuild of wall depending on severity of cracking. Carry out trial holes to ascertain foundation depth and soil conditions. Underpin shallow foundations to a depth unaffected by clay heave or seasonal ground movement. Crack stitching using bed joint reinforcement. Carry out CCTV survey of drains and carry out repairs as necessary. Remove tree, introduce relieving arch over base of trunk or take down section of wall and replace with railings, etc. Introduce movement joints at centres to suit type of bricks and wall construction.

Frost/salt damage 	Poor re-pointing of brickwork using hard cement mortar resulting in freeze/thaw action of moisture trapped within bricks. Under-fired bricks resulting in softer bricks being more susceptible to frost action. Lack of damp proof membrane/coping resulting in brickwork becoming saturated. Salt damage of brick surfaces due to salts entering brickwork from gritting of roads/ footpaths.		Cut out cement mortar and repoint with lime mortar mix. Cut out spalled bricks and re-stitch new to match existing or re-dress brick faces with proprietary repair mortar. Introduce coping stones with dpm. Inject dpc at base of wall. If possible protect wall from ingress of gritting salts (eg. coatings?).
Trees/ Vegetation 	Lack of vegetation management results in growth exerting pressure on wall. Plant roots growing in mortar joints.	As trees mature there is a risk of the wall being damaged by the roots and from windblown branches. Damaged sections may have to be re-built, perhaps with 'bridges' to carry the wall over the roots. The removal of large trees can also lead to problems because the soil accumulates more moisture and can expand. Consider cutting climbing plants, allowing the foliage to die before removing it, and supporting re-growth clear of the wall.	Remove tree, introduce relieving arch over base of trunk or take down section of wall and replace with railings, etc. Remove vegetation from joints, repoint joints and prevent vegetation from re-attaching to brickwork.
Impact damage 	Physical impact by vehicle.	Minor scratch marks or scoring of the surface may obscure more significant cracks. Piers at vehicular entrances may have been dislodged by impact and be unsafe. In such cases they should be rebuilt.	Rebuild/ repair defective sections of wall. Fully bonded brickwork or crack stitching with introduction of bed joint reinforcement.

Change of use/ circumstances (eg. retaining, undermined, exposure, drains, trees, etc.)	Wall now retains ground although originally not intended. Materials piled against wall. Foundations to new structures adjacent to wall undermine existing wall foundations. Wall previously protected from wind becomes exposed due to demolition of surrounding buildings.		Reduce height of retained soil or remove materials piled against wall. Underpin undermined foundations. Introduce additional support to wall (eg. buttress walls) to support additional lateral loads.

Sources of Reference

BRE Good Practice Guide No.13