

## SCOSS ALERT

September 2014

### PREVENTING THE COLLAPSE OF FREE-STANDING MASONRY WALLS

#### BACKGROUND

There have been collapses of free-standing masonry walls over many years and there have been fatalities and numerous injuries; particularly to children. Although reasons for failures vary these walls can be safety critical structures which have to be treated with respect.

#### WHO SHOULD READ THIS ALERT?

This Alert is aimed at those who design, construct, inspect or maintain free-standing walls which front onto streets, paths, yards or gardens or walls within buildings. Owners, contractors, engineers, surveyors, local authority building control officers, insurers and others whose work brings them into contact with walls should heed this Alert. Everyone in the building industry should be aware of the dangers of vulnerable walls such as: those that appear to be very slender, those which are loose, those that have different soil levels on each side, those that lean, and those where there are signs of damage or deterioration.



**Garden wall**



**Wall with soil on one side**

**A child was killed in each of these collapses**

#### COLLAPSES

There have been numerous instances of collapses and a number have resulted in fatalities and injuries. When walls collapse they tend to fall as slabs of masonry which break up on contact with the ground. Irrespective of the force causing the collapse if a person is between such a slab and the ground, and particularly if the person is shorter than the height of the wall, then they are subject to a traumatic blow which can be fatal. It is well known that many free-standing walls are often poorly constructed and not adequately maintained. Warnings were given about them in the Ninth SCOSS Report in 1992<sup>(1)</sup> and in the 11th SCOSS report in 1997<sup>(2)</sup> so the topic is not new but it is timely to address it again.

Examples drawn from the Structural-Safety data base<sup>(3)</sup> include:

- A 1.7m high boundary wall to the front garden of a domestic property collapsed suddenly onto a pavement resulting in the death of a child. The wall was subject to lateral pressure from an adjacent tree and materials stored behind it.
- A woman died after a wall collapsed due to high winds as she was passing by.
- A boy was walking past a 6.5m high wall when it collapsed and killed him.
- A young lady was sitting on an unstable patio wall which fell and a half tonne slab of wall broke her neck in two places.

- A three-year-old girl died when a 2m high and 50m long free-standing blockwork boundary wall fell onto her as she walked past with her mother.
- A 2.5m high blockwork retaining wall suddenly collapsed causing another fatality.
- An 18m length of 2m high dense concrete block retaining wall collapsed hours after being backfilled and it was fortunate that no one was injured.
- A wall 4m high and 18m long weighing 40 tonnes collapsed into a road. The roof of an old building had been taken off thereby removing lateral restraint to the wall which had been left as a boundary.
- An internal corridor wall 37m long by 3.8m high collapsed in a school under construction due to internal wind pressure.



**Internal wall that collapsed due to wind during construction**

There have been many articles in the press about similar events.

Most simple walls however are not been structurally designed, or selected in accordance with recognised guidelines, but are constructed by small builders or householders. They often have excessive height to thickness proportions and are without adequate piers, buttressing or reinforcing. Of particular concern is the danger to children of unsafe walls. Children tend to play around, climb on, and impact on walls.

Outside the UK the situation is similar and there are press reports from many countries when falling walls have proved fatal. Where there is seismic activity the consequences are much worse and simple masonry walls can cause huge losses of life as they succumb to the effects of earthquakes.

## **BUILDING REGULATIONS**

Under current England and Wales Building Regulations Part A<sup>(4)</sup> there is no requirement to submit designs or drawings for new free-standing walls or retaining walls unless these provide lateral support to the foundations of another building. If a boundary wall is a retaining structure but not directly associated with a building then it does not come within the requirements of these Regulations. A Circular Letter was issued to all Building Control bodies in England and Wales in 2013 from the Department of Communities and Local Government (CLG) reminding them of the dangers of freestanding and retaining walls <sup>(5)</sup>. The CLG Planning Portal also advises on the need for planning permission for walls higher than 1m adjacent to a highway and on safety matters <sup>(6)</sup>.

In Scotland freestanding walls are subject to building regulations, and in the most part would require a building warrant - Building (Scotland) Regulations 2004. If it can be shown, or suspected, that an existing wall is dangerous then a Local Authority in England and Wales has powers under the Building Act to take action but has no duty to identify them. One suggestion is that dangerous free-standing walls should be defined as "Statutory Nuisances" making it a duty for LA's to inspect their area and take action by issue of statutory notices.

In addition, the various statutory duties under the Health and Safety at Work Act, and other associated legislation, always apply if the actions are associated with a work activity. In essence this means that those creating the risk by designing and/or creating the wall have a duty to safeguard anyone who may be affected by their actions. Importantly for retaining walls within '4 yards (3.7m) of a street', section 167 of the Highways Act 1980, requires the retaining wall to have approval from the local authority. If this is an adopted public highway, it is a matter for the Highway Authority, which may not be the Local Authority. A company director responsible for a wall that collapsed onto a highway and killed a 3 year old girl received a 2 year jail sentence for manslaughter in 2012.

## **GUIDANCE**

### **Inspections of existing walls**

There are thousands of kilometres of free-standing walls in the UK and it is impractical and indeed unnecessary to inspect them all. However a risk assessment can be helpful in determining which walls merit attention. The risk of a wall causing death or injury depends upon its location in relation to people. If children are habitually in the vicinity this must be taken into account because of their height in relation to the size of wall. If a wall adjoins a pavement or public footpath its condition is more sensitive than if were between fields in a remote country area. However there are walls in rural areas that can be dangerous, for example dry stone field walls are increasingly crossed as Right to Roam

means walkers stray from footpaths. Weathering and deterioration are obvious factors. Vulnerability to impact or other lateral load, whether accidental or deliberate, must also be considered.

The ownership of walls may need to be clarified both at the design stage and in-service. Even major asset owners may not agree about 'demarcation of responsibilities'. If you are not sure who owns, then who inspects?

It can be difficult to see whether a wall is defective enough to be dangerous. Nor is it easy to comprehend that a low wall can become a deadly instrument. A long term campaign is needed to inform and educate those who build such walls without engineering advice which is often the case with walls that fail. Even if the wall has been properly designed and built such structures degrade due to environmental actions, such as the presence of tree roots, as well as by simple aging. A wall which was safe as constructed will eventually become unsafe. Other walls, particularly masonry retaining walls, can be inherently dangerous from the day of construction if there has not been proper design input.

General points to look for when inspecting a wall include the following, although these are by no means exhaustive:

- alterations, such as additions to the wall or removal of adjoining structures
- change of use
- obvious movement or rocking when pushed
- surface crumbling
- condition of mortar pointing
- cracking
- effects of nearby trees
- verticality
- surcharge, filling or excavation on one side
- settlement
- height to thickness ratio
- walls higher than 1.7m
- security of cappings
- changed exposure conditions
- frost and water damage
- impact damage
- damage from traffic
- damage from climbing plants
- poor repairs

Further information on the assessment of existing walls can be found in *Garden Walls*<sup>(7)</sup> on the CLG Planning Portal, *Free-standing Boundary and Garden Walls*<sup>(8)</sup> from Association of Structural Engineers of London Boroughs, and in *Surveying brick or blockwork freestanding walls*<sup>(9)</sup> from BRE. Dangerous walls may be reported to Local Authorities as they have the powers to act in such circumstances.

In many cases an inspection using these points as a check list coupled with basic building knowledge should give some reassurance. If a wall is greater than about 1.7m, then it should have been designed by an engineer in the first place. If the basis of design for a wall of this or greater height is not known or there are significant defects or points of concern then advice should be sought from a suitably experienced structural engineer. The assessment of whether defects are significant depends upon their extent and possibly on a combination of effects. A wall is obviously unsatisfactory if it is retaining material yet its proportions are only those of a simple garden wall. It would also be unsatisfactory if there was evidence of movement or overall looseness such that a modest lateral force could precipitate collapse. Even if a wall is found to be in good condition inspections should be repeated at intervals because deterioration is inevitable and circumstances may change. Records of inspections should be kept.

Free standing brickwork or blockwork may form parapets and if not properly designed, particularly on old or poorly maintained buildings, may be prone to collapse.

### Design of new walls

There are a number of sources of information on the design and construction of walls and anyone responsible for such a structure should ensure that such guidance has been followed. British Standard BS 5628, Code of Practice for the use of masonry which was the standard for many years has been superseded and replaced by Eurocode 6 and

PD6697<sup>(10,11,12,13,14)</sup>. The Brick Development Association *Design of free-standing walls*<sup>(15)</sup> continues to provide detailed guidance on the subject. Empirical rules are given in *Garden Walls*<sup>(7)</sup> including minimum thicknesses for walls of different heights in various areas of the UK depending upon zones of wind strengths. The most important design criterion for engineered free-standing walls is likely to be wind loading.

Other publications relevant to the UK can be found in references<sup>(15,16,17,18)</sup>. Note that some of these have not been upgraded with reference to Eurocodes but empirical guidance for minimum thicknesses is not likely to change. Advice for use elsewhere may be available, for example from Think Brick Australia<sup>(19)</sup>.

Any retaining wall can be dangerous and it is recommended that they should always be designed by a competent structural engineer.

There are also risks for designers and contractors, particularly on site, during construction. Where a wall is safe in its permanent condition it may be subject to more adverse temporary loads during construction and contractors should be aware of what they are building and the Temporary Works Co-ordinator should review temporary situations which may impact on short term stability.

## **CONCLUSIONS**

Risk assessments should be made for existing walls in vulnerable situations especially where children are likely to be in the vicinity. Guidance on the design and construction of new walls is readily available and there should be more publicity about this from all levels in the industry from DIY stores to the boards of construction companies.

## **REFERENCES**

1. [9<sup>th</sup> SCOSS biennial report 1992](#)
2. [11<sup>th</sup> SCOSS biennial report 1997](#)
3. [Structural-Safety data base. www.structural-safety.org](http://www.structural-safety.org)
4. [Building Regulations Part A - Structure](#)
5. [Consideration of amendment of the Building Regulations: Approved Document A \(Structure\) - Freestanding masonry walls](#) 2004 initial impact assessment – published January 2012
5. [Construction and maintenance of boundary and retaining walls](#). Department for Communities and Local Government 2013
6. [Planning Permission Fences, gates and garden walls](#). Department for Communities and Local Government
7. [Garden Walls](#) - Planning Portal - Communities and Local Government Planning Portal
8. [Free-standing Boundary and Garden Walls](#) . Association of Structural Engineers of London Boroughs. 2009
9. [Surveying brick or blockwork freestanding walls](#) – BRE.1992
10. [BS EN 1996-1-1:2005+A1:2012](#) Eurocode 6. Design of masonry structures. General rules for reinforced and unreinforced masonry structures
11. [NA to BS EN 1996-1-1:2005+A1:2012](#) UK National Annex to Eurocode 6. Design of masonry structures. General rules for reinforced and unreinforced masonry structures
12. [BS EN 1996-2:2006 Eurocode 6](#). Design of masonry structures. Design considerations, selection of materials and execution of masonry
13. [NA to BS EN 1996-2:2006](#) UK National Annex to Eurocode 6. Design of masonry structures. Design considerations, selection of materials and execution of masonry
14. [PD 6697:2010](#) Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2
15. [Design of free-standing walls, J O A Korff, Brick Development Association](#), 1984 (updated by information notes, August 1995)
16. [Design Guide Clay Brickwork Freestanding Walls](#). Ibstock Brick Ltd. 2001
17. [Building simple plan brick or blockwork freestanding walls](#) – BRE. 1994
18. [Building brickwork or blockwork retaining walls](#). BRE. 1996
19. [Design of Free-Standing Clay Brick Walls](#) Think Brick Australia. 2007

### **CROSS Reports from Reference 3**

- 3.1 [59 Fatality from free-standing wall collapse](#)
- 3.2 [75 Some press reports on wall collapses in January 2006](#)
- 3.3 [76 Retaining wall collapse](#)
- 3.4 [82 Wind on internal masonry walls during construction](#)
- 3.5 [94 Serious injury from free-standing wall collapse](#)

- 3.6 [99 Collapse of a wall during construction](#)
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- 3.15 [306 Wall collapse from building in city centre - who is responsible?](#)

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