J.Heard Consulting Ltd

Civil and Structural Engineering

[redacted]

My Ref 1602

23 Belsize Avenue Investments Ltd
c/o Whitestone Estates
13A Heath Street
Hampstead
London NW3 6TP

1 June 2018

For the attention of Mr N Revens

Dear Mr Revens

Retaining Wall to rear of 23 Belsize Avenue, Hampstead, London NW3 4BL

I confirm your instruction of 22 May 2018 to inspect and report on the structural condition of the above. This report is prepared for 23 Belsize Avenue Investments Ltd and follows an inspection on 25 May 2018.

Brief Description of Wall & History

The subject wall is constructed of brickwork and is approximately 7.2m long with return walls of length 3m and 3.8m. The central section of the wall is 2.2m high above the level of the patio decking to the garden flat, but the height increases towards its end and along the returns to 2.8m. Some 900mm to the rear of the subject wall is another brickwork wall forming a planter behind the subject wall. It is understood that the planter was formed in October/November 2017. Apparently, a reinforced concrete footing was installed some 1.6m deep below the upper garden level to support the planter brickwork, which is 225mm thick. The level of the earth in the planter is level with the top of the central section of the subject wall. The higher portion of the subject retaining wall is 337mm thick; the thickness of the central section could not be determined as it was obscured by earth in the planter. Some 3m to the rear of the subject wall close to the flank boundary with No 25 is a clump of 3 trees, some 15-20m high; their leaf structure resembles that of an Ash tree. Some 10-12m further away in the garden of No 25 is located an even larger tree with similar leaf structure. It is understood that cracks have formed in the subject wall over the last 2 years or so.

The geological map of the area shows the site to be underlain by London Clay. London Clay is a highly shrinkable clay, highly susceptible to volume changes with changes in its moisture content. Structures with shallow foundations on such soil are continually moving up and down like yo-yos, depending on the seasons and moisture in the ground.

Description of Damage to Wall

The damage can best be described by referring to Fig 1, which is a sketch of the most obvious cracks. The wall was also checked for plumb in several locations. At location A in Fig 1, the wall leans inwards at the top towards the patio by 45mm. At location B, it leans inwards by 60mm and at C it leans inwards by 68mm. At location D, The return wall adjacent to the gate to the side path leans inwards towards the patio by 40mm. The main retaining part of the wall also bowes inwards towards the patio along its length by approximately 50mm at a location some 400mm down from its top.

Discussion

The pattern of damage is consistent with differential foundation movement, with the central section of the main retaining part of the wall moving downwards on its foundations compared to the higher parts of the wall and return walls. The raking cracks so formed are characteristic of subsidence damage. The crack damage can be classed as moderate damage, in accordance with the classification given in the Building Research Establishment Digest No 251, entitled "Assessment of Damage in Low-Rise Buildings".

Further investigation would be required to prove the subsidence theory and the cause, but the most likely reason is shrinkage of the clayey subsoil beneath the foundations due to desiccation caused by the abstraction of moisture from the soil by tree roots from the nearby trees, possibly exacerbated by shallow foundations and dry weather. This is corroborated by the shrinkage gaps in the soil between the lawn and the planter wall and between the soil in the planter and the rear of the subject wall.

As stated above, the pattern of crack damage is consistent with downward movement. It is considered that it has not been caused by lateral movement due to the weight of soil behind the wall, even though the distortion of the wall shows it is under pressure. The leaning and bowing distortion looks to be of some considerable age. Whilst the distortion is considered to be unrelated to the subsidence damage and probably preceded it, the subsidence may have exacerbated the distortion somewhat. Notwithstanding this, the subject wall is understood to be of some considerable age and as such, it has passed the test of time.

Given that the cause of cracking is considered to be due to downward movement, it follows that the recent construction of the planter wall behind the subject wall can have had no material influence on the present condition of the subject wall. Indeed, by levelling the soil behind the wall rather than have it banked up, relieves some pressure from the subject wall.

With respect to the distortion, a lean of almost 70mm, whilst not ideal, is within acceptable tolerances for a 337mm thick wall. A thinner wall would be verging on being structurally unstable. The higher parts of the wall are 337mm thick. It is reasonable to assume that the main section of the wall is of similar thickness, but this should be verified.

Recommendations

A site investigation should be carried out to confirm the cause of cracking and ascertain the width of the wall and the depth of its foundations. It would be a waste of money to undertake remedial works at this stage without determining the cause of the damage. The cause may also shed light on whether the damage is likely to be progressive.

If tree root induced subsidence is confirmed, then the normal method to deal with the problem is either to drastically prune the culprit trees or more likely in this case, remove them altogether. Following a period of recovery, when the ground recovers its natural moisture content and during which the structure is monitored to determine when relative stability is reached, repairs can be carried out. This will likely entail cutting out the cracked sections of brickwork and re stitching it back together. Modern resin bonding techniques are unlikely to be a successful alternative to the traditional brick stitching method as the mortar in an old wall is likely to be of a relatively weak mix. A specialist firm may be able to install some bed joint reinforcement across the cracked areas as an added safeguard, but again, with weak mortar, there is a risk that the reinforcement will be ineffective.

Removing trees on clayey soil causes heave in the short term. Whether this will affect the subject wall and nearby structures depends on the depth and degree of desiccation, data which will be determined by the investigations recommended.

Alternatively, if the trees are to remain, then the foundations of the wall will likely need to be underpinned to take them below the influence of the tree roots to prevent a reoccurrence of the damage.

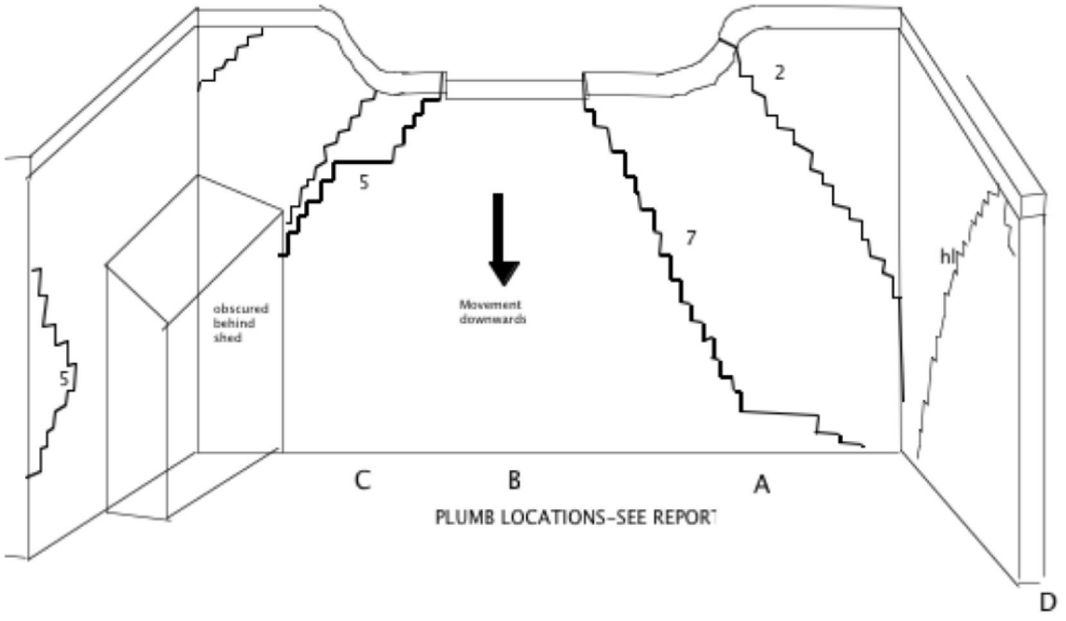
No weepholes* were noted: they may be present below the level of the decking and gravel base. If there are none, some weepholes should be drilled in the base of the wall with a coring tool to prevent the build up of water behind the wall. 75mm diameter holes angled slightly downwards at 2m centres is a common specification.

I trust this Report is adequate for your purposes. Please let me know if you have any queries, meanwhile I enclose a note of my fee.

Yours sincerely

J Heard Consulting Ltd

* Holes drilled close to the base of the retaining wall to allow water to escape from behind the wall



5 Approx crack widths in mm
hl = hairline

Dwg Title: SKETCH OF DAMAGE TO RETAINING WALL TO REAR OF 23 BELSIZE AVENUE, NW3 4BL	J Heard Consulting Ltd Civil & Structural Engineering [redacted]		
Client: 23 Belsize Avenue Investments Lt	job No 1602	E	Dwg No Fig 1
	Dsn Date 5/18		Scales not to scale
	Chkd Date		