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UNITED KINGDOM

Introduction

We have advised in our Engineers Report that following the appearance of persistent cracking in 2014, being concerned that the damage may be due to subsidence, a claim for subsidence damage was submitted to insurers.

The policyholder advised that significant crack damage was identified in the Garden Flat during the summer of 2014, following smaller scale persistent cracks to internal walls noted at the property before this date. The policyholder also advised that the Garden Flat had been renovated at the time of purchase in 2011.

An application to fell an Elm (T3 of this report) and Acer (T2) was made in December 2015. This follows a previous application to fell T3 of this report and a Sycamore (at No. 94 Haverstock Hill) submitted to Camden Council in July 2007, and a 2011 application concerning two Sycamores at 94 Haverstock Hill.

The following is a summary of the damage relating to the insurance claim, including any unrelated damage in the same vicinity. At Camden Council's request, additional photo evidence was provided by the policyholder in September 2016 to show further, progressive internal damage to the property since June 2016.

INTERNAL GARDEN FLAT:

FRONT LEFT SIDE BEDROOM:

Diagonal tapering cracks in the region of 10-15 mm in width were recorded to the right side and rear walls of the bedroom around the en-suite bathroom, hallway doors and ceiling.

Two further vertical tapering cracks in the region of 1-2 mm in width were recorded to the front bay. An area of dampness was also recorded to the front bay and is the subject of further investigation.

FRONT RIGHT SIDE BEDROOM:

Diagonal tapering cracks in the region of 2-3 mm in width were recorded to the right side wall of the bedroom to underside of the window. Diagonal tapering cracks in the region of 20-25 mm in width to the front wall above the hallway door. A crack was recorded to the ceiling close to the hallway door.

The bedroom floor was also recorded to have dropped in the region of 20mm.

EN-SUITE:

Cracks in the region of 1-2 mm in width were recorded to the en-suite tiled flooring, back wall and ceiling.

FRONT RIGHT STUDY:

The study timber flooring was recorded with downwards movement in the region of 15-20 mm resulting in a gap with the skirting.

HALLWAY:

The hallway timber flooring was recorded with downwards movement of approximately 30-35-mm resulting in a gap with the skirting. Diagonal tapering cracks in the region of 15-20 mm in width were recorded to the left side wall of the hallway to above both the bedroom and bathroom doors and surrounding the entrance to the kitchen.

BATHROOM:

Horizontal and vertical tapering cracks in the region of 1-2 mm in width was recorded above the hallway door and the ceiling. Vertical cracks in the region of 1 mm in width were recorded to the rear tiled surface to the rear of the bathroom, and cracks 10-15mm to the tiled floor.

REAR LEFT LOUNGE:

A number of both horizontal and diagonal cracks in the region of 2-5 mm in width were recorded to the front right of the lounge above the hallway and kitchen doors, with surrounding damage to the plasterwork. A further diagonal crack in the region of 2-3 mm in width was recorded to the front wall of the lounge. The lounge floor was also recorded to have dropped along the right side kitchen wall in the region of 20 mm.

REAR RIGHT KITCHEN:

A number of both horizontal and diagonal cracks in the region of 5-10 mm in width were recorded to the front right of the lounge to above the hallway and kitchen doors, and cracks in the region of 1-2mm around the rear window and right side wall. The kitchen floor was also recorded to have dropped along the right- and left-side kitchen wall in the region of 20 mm.

Camden Council requested whether damage has been evident to other flats in the building. Crack damage does exist to the flat situated directly above the Garden Flat and generally this damage is consistent with the internal crack damage and movement to the garden flat.

EXTERNALLY

FRONT ELEVATION, ENTRANCE STEPS AND PORTICO:

Crack damage was recorded in the form of render deterioration to both the front entrance steps, portico and boundary walls to the property.

Notes since the Engineers' Report Dated December 2015:

- Site investigations were undertaken in 2014 (Drain survey and the excavation of x2 trial pits / boreholes); a further investigation in 2015 (x1 borehole and a further comprehensive drain survey to all drain runs in April 2015); and a further internal site investigations undertaken (x1 borehole in the bedroom of the property) in September 2016 at the request of the Local Authority.
- A copy of the factual site investigation reports, including most recently internal investigations in the report dated 30th September 2016 provides further information. Officials from Camden Council were present during the September investigations and confirmed they were content with the method and location of the investigations, and that multiple roots were observable during the excavations. The building foundations within the area of damage were found to be at a depth of 300 mm below (the lower) ground level (bgl), bearing onto a subsoil comprising of a very stiff clay with the presence of tree roots to a depth of 3500 mm bgl.

Functionally active (alive) tree roots were identified below the focal area of movement / damage (ITP/BH4) and have been identified as having emanated from the genus Acer spp. (maples, including sycamore) and Ulmus spp. (elms).

The only plausible source of the above roots are the Acer (T2) and Elm tree (T3) which stand to the front and side of the insured property.

The policyholders have also submitted further evidence at the request of Camden Council including details of the structural works undertaken in 2011 and photographic evidence of the damage noted above. It is our expert opinion that these support our view that all other possible cause of movement have been eliminated, and the only plausible cause for the subsidence identified are the Acer (T2) and the Elm tree (T3).

- During site meetings in June 2016 and September 2016 with the local authority officers, we noted areas of new crack damage to the front elevation, boundary walls and right side of the front entrance steps. We consider this is in keeping with foundation related movement i.e. subsidence. The indicated mechanism of movement is downwards internally to the right side of the property.
- Drainage surveys were carried out to the right side of the building and with the area of subsidence damage. The drainage investigation report dated 18 December 2014 provides further details. All drainage runs surveyed were found to be in a serviceable condition and did not require any repair.

At the request of Camden Council, a further drainage survey was carried out on 5 April 2016. A copy of the factual report dated 7 April 2016 is attached. All runs were cleaned by high pressure water jetting prior to the CCTV survey. The contractor has recommended minor repairs; however, it is noted that the drainage runs recommended for minor repair are all located outside of the area of subsidence movement. The main drainage runs within the area of subsidence movement are all noted to be in a satisfactory condition and not requiring repair. We confirm that we do not consider damaged or leaking drains to be a material cause of the current subsidence damage and soil analysis confirms this position.

- In 2016 Camden Council requested further details regarding the works to the front steps of the property in January 2009, and these were submitted in June 2016. The previous subsidence claim was progressed by another loss adjuster. We understand from documentation supplied to us in the form of a final Certificate of Structural Adequacy that a scheme of mini piling was utilised, known as Shire Stabiliser. We have been provided with the design/construction drawings that show up to 8 piles were installed to the front section of the steps. It is possible that the Shire scheme whilst providing additional support to the front step foundations has not totally achieved stability of the steps as seen from the level monitoring exercise. A copy of the final Certificate of

achieved stability of the steps as seen from the level monitoring exercise. A copy of the final Certificate of Structural Adequacy is provided for further information.

We are of the opinion that the previous scheme to stabilise the front entrance steps located on the right side of the building utilising a number of piles (Shire Piling) has not prevented the internal areas of the property being affected by root induced clay shrinkage subsidence. The scheme of piling to the front entrance steps has not prevented tree roots from affecting the shrinkable clay sub soil beneath the building foundations internally to the property.

- Further information in response to queries / requests by Camden Council was provided in June 2016 in the report "Response to Camden Council by Innovation Property (UK) Ltd, June 2016".

Mitigation

An arboricultural assessment report has been obtained concerning the vegetation to the front of the property. The report dated 20 October 2014 provides some further information.

The arboricultural consultant has advised that they have implicated T2 (Acer) and T3 (Elm) as the only likely source of movement to the property. The report identifies that that the footings of the subject property fall within the anticipated rooting zone of this vegetation.

Vegetation is therefore deemed to retain the capacity to be causal to the current movement and building damage. In assessing the potential drying influence of the vegetation on site, T2 (Acer) and T3 (Elm) are considered the dominant features and accordingly they have been identified as the principal cause of subsidence.

The arboricultural consultant has recommended the removal of T2 (Acer) and T3 (Elm).

Summary and interpretation of Monitoring

Level monitoring involved fixing pins around the perimeter of the building from which levels were taken to determine where the external walls and hence by implication the foundations are moving, and by how much.

Level monitoring was set up in October 2014 and readings have been taken at approximately 8 week intervals.

The monitoring locations which are as shown in the most recent monitoring report dated 4 October 2016.

The level monitoring has shown that the property is affected by seasonal downward movement to the front elevation/steps with the maximum degree of seasonal downward movement occurring to point 4 in the region of 10 mm overall.

The monitoring shows the affected parts of the property moving down during the summer months when the trees are in leaf, demanding larger amounts of water and rainfall is lower and the net moisture content within the clay soil below the property decreases.

Recovery or upward movement is then witnessed during the winter months when the tree loses leaf, demands less moisture and the rainfall events increase, allowing the soil to rehydrate to some degree and swell, causing upward movement and consequential closing of cracks within the property.

While it was not possible to identify a suitable remote datum, the readings have been made relative to Level Station 10 with an assumed value of 10.00m at the time of each reading.

The level monitoring program to date clearly indicates downward movement through summer 2014, 2015 and 2016 with recovery becoming evident with the onset of the wetter winter months.

This seasonal pattern of movement clearly demonstrates that the identified T2 and T3 are the cause. Where vegetation is involved it produces a characteristic 'seasonal' pattern of foundation movement (subsidence through the summer, recovery through the winter); no other cause produces a similar pattern.

While climate alone can cause some small changes in the surface soil (to a depth of 500 mm or so), the foundations of the house, being some 3000mm below ground level are beyond this zone and seasonal movements of the scale shown are indicative of root-induced shrinkage associated with a large tree.

In this instance, the only significant vegetation within influencing distance of the front and right side of the property are the Acer and Elm.

Amendment: The most recent level monitoring readings to 29 September 2016 are attached in the report dated 4 October 2016. This continues to show that the building foundations are being affected by seasonal downward and upwards movement, consistent with the seasonal pattern identified above.

Remedial Works

The building damage is generally considered to be Category 3 (Moderate) and in structural terms, it will be expensive to rectify because of the area of damage and the extensive remedial work and decorations that will be required. Even if there were any doubt as to the extent of the damage that can be reasonably attributed to the influence of the nearby trees the current recorded seasonal foundation movements are unacceptable. If the influence of the implicated

trees is not eliminated, an engineering solution will be needed to stabilise the property.

A range of underpinning solutions are available, depending on the area that requires stabilisation and the depth required. Traditional, mass concrete, underpinning is generally the most economical solution where the required depth is relatively shallow. It has the added advantage that the underpinning also acts as a root barrier. However, it tends to become uneconomical, and the Health & Safety considerations become increasingly onerous, where the required depth exceeds 2.5 m.

Most underpinning is extended to a metre below the last discovered root and this, in this instance, is 3.0 m bgl, making this an unacceptable risk from a health and safety perspective and should therefore be discounted.

A pile-based underpinning solution tends to be more economical where (i) the required depth exceeds 2.5 m and (ii) it is necessary to stabilise internal walls as well as external walls.

A common variant is the piled-raft which consists of a reinforced concrete slab under the entire footprint of the property supported on driven or bored piles.

It is very difficult to partially underpin a property with a piled raft as the transition between stabilised and un-stabilised parts of the property is very vulnerable to cracking as a consequence of the minor seasonal fluctuations which might be expected in the traditionally founded part relative to the very stable piled section.

The scheme will comprise of a partial underpinning scheme located internally to the Garden Flat. This will require a period (estimated up to a year) of alternative accommodation for the Garden Flat owners which will significantly increase the overall cost of any engineered solution. Estimated costs of repair to the building are £125,000 if an engineered solution is required (not including significant relocation costs for the residents and professional fees to bring the case to the lands tribunal).

Granting permission will limit these costs; for the avoidance of doubt, in the event of a refusal our client will seek to secure compensation for the additional costs incurred through a section 202(E) claim. It is the expert opinion of both the case engineer and arboriculturalist that the supporting information clearly demonstrates the influence of the trees identified above.