Subsidence Management Services

ENGINEERING REPORT

Name of Engineer:	Peter Moore MCIOB Dip CII (Claims)
SMS Reference:	IFS-ESU-SUB-16-0062003
Name(s) of property Owners:	Mr Grant Fidler
Address of Property:	2 Elmgrove Close, Woking, Surrey, GU21 8XL
Date of Report:	05/01/2018

Figure 1 – The property with vegetation to rear.

1. Scope of instructions:

In mid-April 2016 Subsidence Management Services (SMS) were instructed by Insurers esure to investigate subsidence damage to the rear of the above property. A survey of the damage subsequently took place on the 29th of April 2016.

This report has been prepared to support an application to remove statutory protection on implicated vegetation and removal of the same to stabilise the rear of the property and prevent future damage to the remainder.

2. Documents considered

The key documents considered in the report are listed below.

Table 1 – Documents considered

ID	Produced by	Description	Date
1	SMS	Engineer's Report	05/05/2016
2	SMS	Site Investigation Report	09/06/2016
3	EPSL	Root ID report	31/05/2016
4	Environmental Services	Consultant report on trees	17/10/2016
5	SMS	Level Monitoring Report	17/11/2017

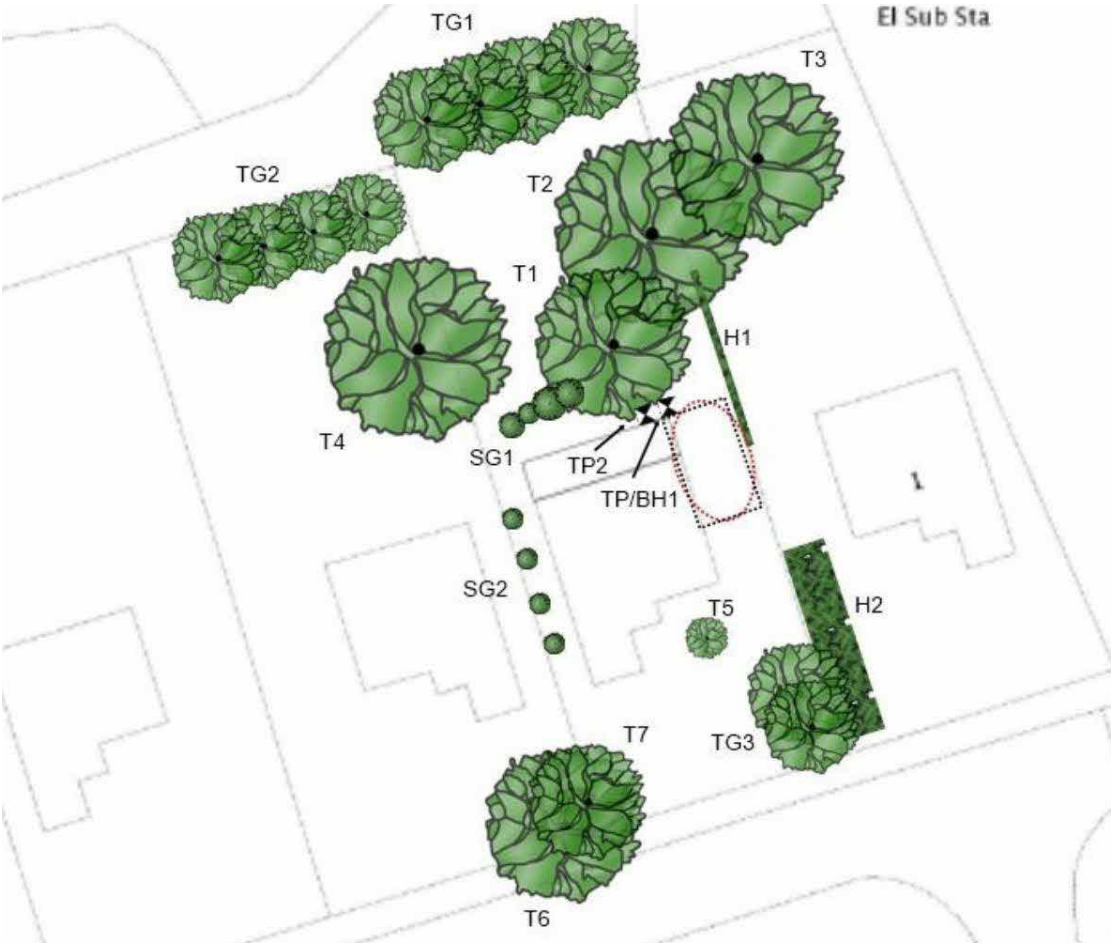

Figure 2 – Sketch taken from Environmental Services survey showing location of the principal vegetation in relation to property at the time the damage occurred.

3. History and background

The property is a two storey detached house of traditional construction with rendered brickwork walls surmounted by a gabled tile covered roof. The property has four bedrooms and was constructed around 1950. The property benefits from two single storey extensions extending along the rear elevation. These were added at different times with the one to the rear of the garage in the 1980s and the other in the 1990s.

The current owner and Insured purchased the property in 2014. At that time there was no mention of any structural damage of concern on the Pre-Purchase Survey Report. The site is gently sloping from front to rear, with a parking area to the front and a garage to the right hand side. There are multiple mixed species of vegetation surrounding the property. A buildings Insurance policy commenced with our principals on the 2nd of April 2014. The damage was first noticed by the Insured in February 2016. Subsequently Insurers were notified of potential subsidence.

4. Description of Damage

Following is a summary of the description of the damage surveyed in April 2016.

Internal:

"Internally, the damage is confined to the two single storey extensions at the rear. Here there are recent stress fractures through the plaster mainly to the right hand extension. The fractures are fairly minor being no more than 2mm in width. The pattern and direction of the fractures suggest evidence of minor subsidence at the head of the wall that divides the two extensions. The most severe fracture is below the right hand window. This fracture is mirrored externally. There is also some minor lateral movement of the window sill towards the dividing wall. Other stress fractures were noted to the plaster around the dividing doorway and beam; as well as in the corners. It is possible that there has been some recent rotational movement occurring to the right hand flank wall."

External:

"Externally, there is a minor vertical fracture through the render to the rear elevation below the right hand window. This has at some stage been painted over. The position of this fracture mirrors the position of the more pronounced internal fracture. Along the right hand flank there are two historic diagonal fractures that extend virtually the height of the elevation. At some stage these have been filled with a mastic and the fractures have slightly re-opened. Along the left hand flank of the later extension there is again historic mastic fill at the junction with the main rear elevation. The pattern of the mastic fill this suggests that at some stage the structure rotated forwards away from the main property. It is possible that the damage has retracted over the winter period."

5. Evidence of root encroachment & soil conditions

In June 2016 a geotechnical investigation was commissioned on a without prejudice basis to confirm the cause of the subsidence. The outcome of the investigation was summarised as follows.

"The geotechnical investigation comprising two external trial pits and boreholes at the rear of the single storey extensions and at their junction identified the foundation to the 1980s extension to be 0.35m of brickwork sited upon 0.45m of concrete. The overall foundation depth is therefore 0.80m below ground level. The foundation to the 1990s extension was found to be 0.60m of brickwork sited upon 0.70m of concrete. The overall foundation is therefore deeper as expected at 1.30m. Soil samples collected and forwarded to the laboratory testing summarise the underlying sub-strata to be mainly of sandy clay. The clay has medium shrinkage potential. Although not desiccated; there was some evidence of the on-set of desiccation in the clay particularly at 1.30m. Living tree roots were discovered at a depth between 1.30 and 2.30m. These are identified as emanating from the Fagus (Beech) species. The roots will no doubt originate from the protected trees in the rear garden and possibly in the adjoining neighbours.

Oedometer testing was used to calculate the potential of ground heave should the trees to the rear be removed and it has been established that only 5.3mm would occur. This is minimal and would not cause any structural damage to the property. As such these trees can in theory be felled."

6. Drains

A survey of the underground waste and surface water drainage was not required on this occasion as there is no drainage within influencing distance of the area of damage.

7. Monitoring

Level monitoring involves 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 September 2016. Readings have been taken at approximately 8 week intervals. The current results are up to and including the 14th of November 2017. The monitoring results, which are presented in below, show that the property is affected by seasonal downward movement at the rear right corner of the 1980s extension; particularly at point 9.

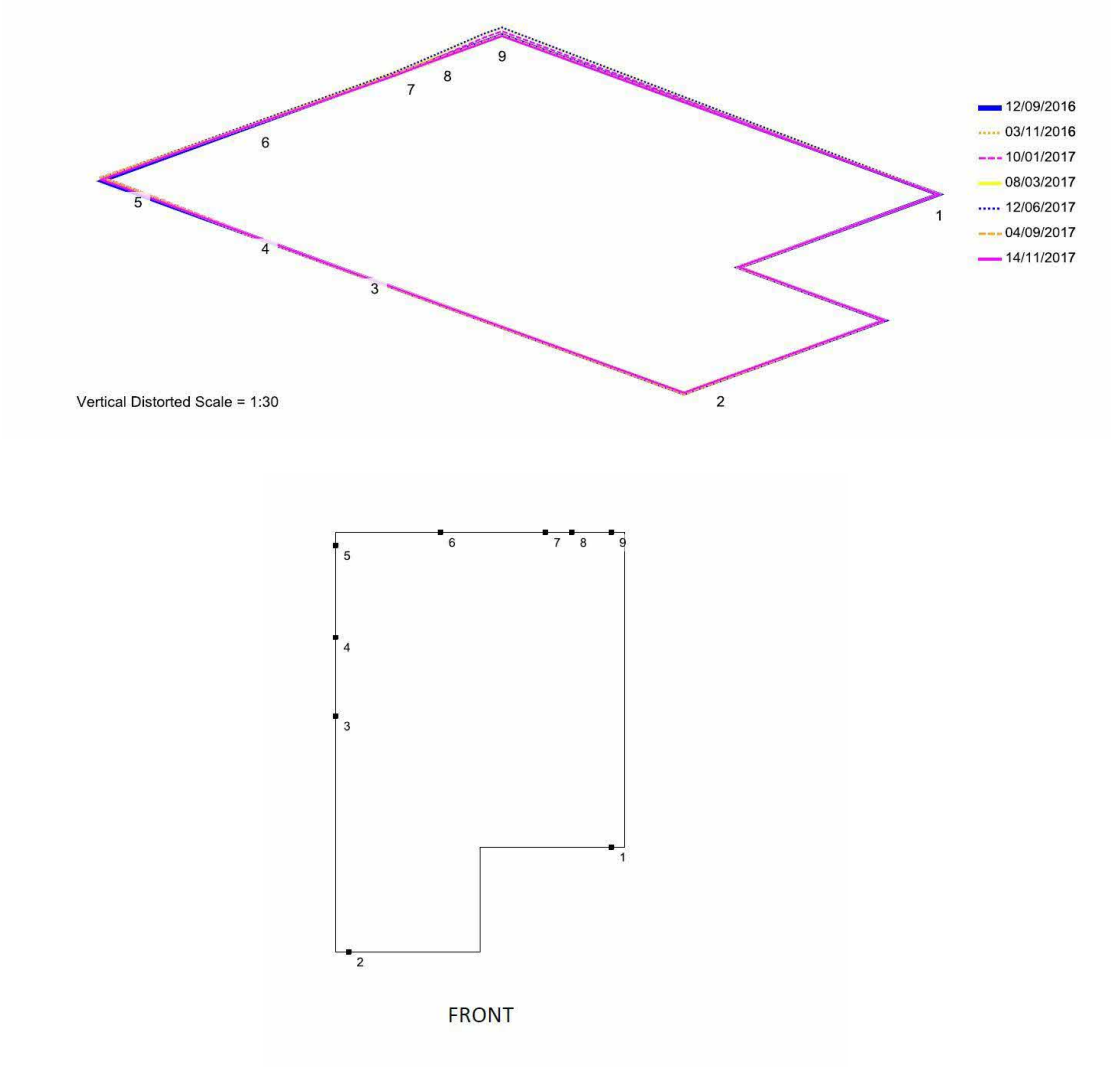

Figure 4 – Monitoring location positions

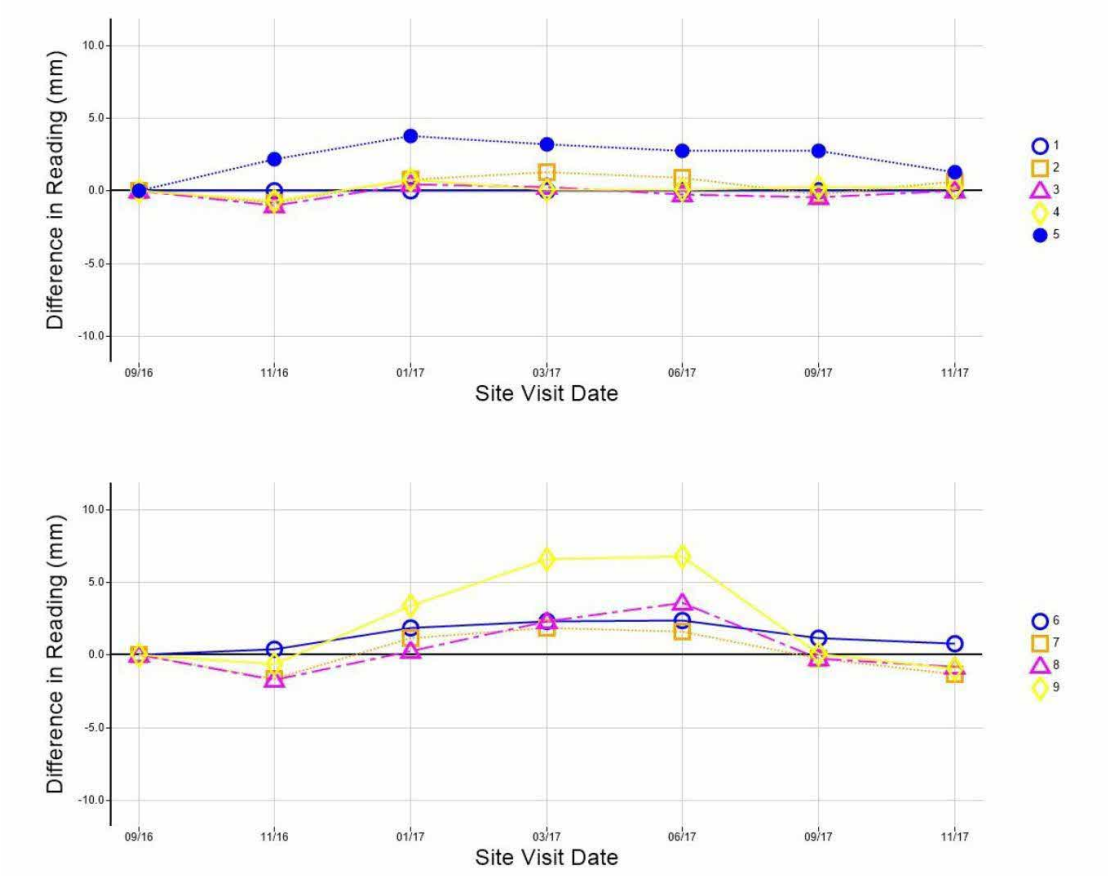

Figure 5 – Level monitoring results.

8. Cause of Damage

In my opinion, the evidence points conclusively towards the damage reported in 2016 having been caused by root-induced shrinkage in the subsoil. Specifically, we have:

- Damage wholly characteristic of that caused by subsidence of the site beneath the foundations.
- The damage is focussed to the rear of the property (when viewed from the front) within influencing distance of the vegetation; namely Pine (T1) and Beech (T2).
- Damage which recovered at the rear right corner of the 1980s extension (Point 9) over the winter of 2016/2017 by approximately 7mm and then opened up again as the corner subsided by the same amount over the summer of 2017. Clearly demonstrating a pattern of seasonal movement directly in line with the Pine (T1) and Beech (T2).
- Evidence of root activity to 2.3m below ground level from the Fagus (Beech) species with moderate (and more recently abundant) levels of starch.
- A clay subsoil with medium shrinkage potential.
- No drainage within influencing distance.

Given its size, proximity and the presence of *Fagus* roots in the subsoil, the Beech tree (T2) is the most likely explanation for the seasonal movements recorded at the rear of the property. However, given the size and close proximity of the Pine (T1) this tree cannot be discounted as a contributory factor to the damage; despite roots from this tree not being recovered from the geotechnical investigation.

The monitoring results (*Figure 5*) clearly indicate an unacceptable scale of seasonal foundation movement of the property. Movement is most pronounced at the rear right corner of the 1980s extension at point 9 which is in close proximity to the position of the Pine (T1) and Beech (T2).

9. Remedial options

Although the damage is relatively minor in structural terms, should further seasonal movement be allowed then the damage will no doubt become more pronounced and wide spread and ultimately become more expensive to repair. If the influence of the vegetation is not eliminated, an engineering solution will be required 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 2.50m. Most underpinning is extended to a metre below the last discovered root. In this case it would mean that the underpinning would need to be extended to a depth of 3.30m. Thus making this an unacceptable risk from a health and safety perspective and should be discounted.

Pile-based underpinning solutions tend to be more economical where (i) the required depth exceeds 2.50m 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.

In this instance, I would discount the use of traditional underpinning because of the depth of the root activity indicated in the Geotechnical Report. In addition, the potential benefits of the barrier provided by the traditional underpinning are likely to be outweighed by the advantages that a piled raft offers in providing a long term solution.

In the light of the depth of the roots found, to undertake a piled raft scheme to the main house and extensions could easily cost in excess of [redacted] professional fees and ancillary costs such as alternative accommodation.

I have considered whether the vegetation could be controlled by regular pruning. However, recent research indicates that even heavy canopy reduction is likely to be effective for no more than one growing season. In my view it would be impractical to place the burden of annual tree management on the owners; especially when the trees can be felled without any risk of ground heave as confirmed by the Oedometer soil test results which confirmed a heave risk of a mere 5.3mm.

Annual management, in any case, would destroy most of the amenity value of the tree which would be the only impediment to its removal. It would also leave the property susceptible to damage in an exceptional summer such as 2003 when even recently-pruned trees caused significant soil shrinkage.

10. Summary of Conclusions

The nature and distribution of the cracking first reported in 2016 was indicative of subsidence with the focal point of the movement at the rear right corner of the affected 1980s extension. This damage retracted over the winter of 2016/2017, before becoming worse throughout the driest months of 2017.

Root samples recovered from below foundation level and identified as *Fagus spp* indicate that roots from the Beech tree (T2) encroached into the soil underlying 2 Elmgrove Close, Woking, Surrey, GU21 8XL. It is almost certain that roots from the Pine (T1) will also encroach beneath the property given its size and close proximity.

Soil testing has confirmed the underlying sub-strata to be of medium shrinkable clay.

There is no drainage within influencing distance of the area of damage.

The level monitoring has confirmed that the foundations are moving seasonally and with greater movement at the rear right corner of the 1980s extension, closest to the Beech (T2) and the Pine (T1).

The submitted evidence therefore points conclusively towards this vegetation being the substantial and effective cause of the damage that appeared in 2016. The scale of the movement associated with the tree to be unacceptable.

If both the Beech (T2) and the Pine (T1) are not removed, it will be necessary to underpin the property to prevent a recurrence of the damage. The only possible and effective scheme is likely to be a piled raft scheme given the depth of the roots from T2. The cost of the scheme is likely to be in the region of [redacted] exclusive of VAT, professional fees and ancillary costs.

The current cost of superstructure repairs is estimated to be less than [redacted] VAT).

Alternative methods of reducing the influence of the implicated tree, such as annual pruning or the installation of a root barrier are not practical in this instance.

11. Statement of truth:

I confirm that insofar as the facts stated in my report are within my own knowledge I have made clear which they are and I believe them to be true, and that the opinions I have expressed represent my true and complete professional opinion.

Signed: [redacted] …….

Name of Engineer: Peter Moore MCIOB Dip CII (Claims)

Dated: 05/01/2018