

THiSSolutions Ltd

Structural Inspection Report

**Growth of Adjacent Tree
Bretton Lodge
1, Park Lane
West Bretton
WF4 4JT**

Client: Mr. David Woodhead

Date: 6th November 2022

TSI 22135

Growth of Adjacent Tree, Bretton Lodge, WF4 4JT

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1.0 Client

1.1 Mr David Woodhead
Bretton Lodge
1, Park Lane
West Bretton
WF4 4JT

2.0 Subject of inspection

2.1 This report considers the large conifer located to the south-west of the main property at Bretton Lodge, the adjacent estate wall, and the associated structure.

3.0 Date inspected

3.1 31st October 2022.

4.0 Terms of reference

4.1 To assess and comment upon the structural effects of the large conifer located to the south-west of the main Grade II listed residential property at Bretton Lodge.

5.0 Limitations

5.1 The investigation is generally confined to the agreed terms of reference. This report does not constitute a full structural investigation or assessment of the adjacent property as a whole.

6.0 Brief description

6.1 The residential property at Bretton Lodge is understood to have been built around 1740. The property is Grade II listed, and the Historic England Listing Number is 1184768. The approx. National Grid location is SE 28748 13523.

6.2 For the purposes of orientation when reading this report, the main Bretton Lodge residential property is to the north, the lawn and main garden are to the east, open countryside lies to the south, and the estate wall and outhouse are to the west.

6.3 Reference should be made to the photographs included in Appendix A1 of this report.

7.0 Observations

7.1 Adjacent conifer tree

7.1.1 A large conifer, which is the subject of this report, is located approx. 6m from the south-west corner of the main property, and approx. 1.5m to the east side of a tall masonry estate wall that divides the main garden area from an adjacent vehicle parking area. (Photo A1.1).

- 7.1.2 The tree is believed to be a male Atlas Cedar (*Cedrus Atlantica*), which when fully mature can reach heights of around 20m. The tree has been identified from the distinctive appearance of its bark, the clustered growth pattern of the foliage, and its flowers, which give off a fine yellow pollen. (Photo A1.2).
- 7.1.3 A photo, dated as having been taken in Easter 1998, shows the tree as being approx. 8m high at the time. The development of twin trunks is already visible in the photo, and this is a feature of the tree as it currently stands. (Photo A1.3).
- 7.1.4 The tree is currently estimated to have a height of approx. 15m, and a spread of approx. 12m, and would therefore appear to have roughly doubled in size over the past 25 years. (Photo A1.4).
- 7.1.5 Several branches are known to have split as a result of storms Dudley and Eunice, which caused widespread damage across the UK during the week from 13th to 19th February 2022, and during which wind speeds of around 80mph, or 22 m/s, were recorded in the area. The broken stumps of the branches have since been trimmed back, in order to minimise the risk of the onset of fungal decay. (Photo A1.5).
- 7.1.6 The loss of the branches has resulted in the tree becoming somewhat unbalanced in appearance. (Photo A1.6).
- 7.1.7 The tree was noted to have shifted slightly during the storms, with the result that it now has a slight lean towards the property to the north-east. (Photo A1.7).
- 7.1.8 The storms also appear to have caused the south-west side of the root plate to have lifted slightly. (Photo A1.8).
- 7.2 The estate wall
- 7.2.1 The estate wall adjacent to the tree is built of mixed coursed sandstone (west face, towards the vehicle parking area) and handmade clay brickwork (east face, towards the tree and main garden) and is capped with sandstone coping slabs. (Photo A1.9).
- 7.2.2 The wall appears to have been built using an ash / lime mortar, which allows moderate distortions to be tolerated, without causing cracking of individual masonry units. (Photo A1.10).
- 7.2.3 The wall varies in height between approx. 3.5m and 4.5m, and was measured as being approx. 450mm thick.
- 7.2.4 The wall in the vicinity of the tree appears to have a slight lean to the west, estimated visually to be approx. 120mm over its height. (Photo A1.11).
- 7.3 Stone flagged patio area
- 7.3.1 The sandstone paving to the patio area to the north side of the tree was noted to have lifted slightly during the storms in February, resulting in the loosening of the mortar pointing between the flags. (Photo A1.12).

8.0 Discussion

8.1 Stability of the tree

8.1.1 The tree has become partially imbalanced due to asymmetrical storm loss of branches. Apart from the vertical load imbalance that will have resulted, there will also be an imbalance in the lateral load being carried by the tree in windy conditions. This will result in torsional effects being applied to the trunks, with the possibility of further damage, and hence further instability, being brought about as a result.

8.1.2 The unusually strong overturning effect caused by the abnormally high winds in February 2022 appears to have had the effect of lifting the south-west side of the root plate beneath the tree. While this is likely to have resulted in damage to some of the root growth in this area, visual evidence of this is unlikely to become apparent until the commencement of the tree's next growing cycle in the early months of 2023.

8.1.3 It would appear that the larger roots growing to the south-west of the tree have exerted an uplift on the foundations of the adjacent estate wall, resulting in a slight lifting in the bed joint coursing, as well as creating the south-westerly distortion that is visible in the wall itself.

8.1.4 The loss of tree root growth from one side of the root plate has the effect of reducing the tree's ability to withstand winds coming that particular direction. In this case, the damage appears to be to the south-west, which is the normal direction for prevailing winds in this area. Consequently, the risk of further wind damage being caused is considered to be high.

8.1.5 The lateral displacement of the main tree growth towards the north-east will also be exerting an eccentric effect on the anchorage afforded by the remaining root growth, which will have the effect of further increasing the risk of overturning in the future.

8.2 Stability of the wall

8.2.1 The lean that has been induced in the estate wall is approaching the point where the vertical line of thrust through the wall's centre of mass will lie outside of the middle third of the wall's width. If this point is reached, tension forces will start to be induced in the 'outer' (east) face of the wall, which the masonry will not be able to resist. Cracking will then start to develop, and if the degree of lean is not halted by some means, the possibility of collapse will become increasingly likely.

8.2.2 Possible solutions to this problem include the provision of buttresses or the introduction of structural framing to the 'inner' (west) side of the wall, in order to resist overturning; remedial works to the foundations of the wall to prevent further tilting; or the complete demolition of the wall, followed by its reconstruction with new, upon a suitable foundation – all of which would entail considerable expense.

- 8.2.3 A further option would be to consider the removal of the existing tree, followed by its replacement with a new specimen tree, planted in a more suitable location.
- 8.3 NHBC Construction Standards Chapter 4.2
 - 8.3.1 Useful guidance on the influence of trees on buildings is provided in the National House Building Council (NHBC) Standards, Chapter 4.2, Building Near Trees. This document categorises the anticipated water demand of different species of deciduous trees and conifers, and sets out rules by which the influence of different species and ages of trees can be assessed, depending upon the prevailing subsoil conditions.
 - 8.3.2 For this purpose, it can be assumed that the local ground conditions comprise medium shrinkage potential soils, though this could be verified by the excavation of the trial pits in due course.
 - 8.3.3 Given the above, NHBC Standards Chapter 4.2 categorises Cedar trees as being of moderate water demand, and would suggest that a semi-mature tree growing at a distance of around 1.5m from the estate wall would require a foundation depth of approx. 1.8m to obviate shrinkage effects of moisture removal on the subsoil.
 - 8.3.4 Work is currently being carried out on a similar-sized estate wall nearby, whose foundations appear to extend to a depth of approx. 0.9m below the adjacent ground level. Clearly this is significantly shallower than the depth of 1.8m referred to above.
 - 8.3.5 The consequence of this is that without substantial underpinning works, which in this case would in their implementation cause serious damage to the western side of the root plate of the tree, the future stability of the wall cannot be assured.
 - 8.3.6 Even if the guidance provided in the NHBC Standards were to be followed, and the possible decision to underpin the wall's foundations were to be taken, the risk of direct intrusive tree root damage to the wall structure below ground would still be present.
- 8.4 Natural die-back
 - 8.4.1 One aspect of the natural growth progression of Cedar trees is that early-growth branches are shed periodically as the result of natural die-back. This is known to have occurred previously. There is therefore always the risk of branches falling onto adjacent structures or property, even if no other adverse circumstances are present.
- 8.5 Assessment of the risk of collateral damage
 - 8.5.1 The size, age and position of the tree in relation to the surrounding property mean that there is a strong possibility of future damage being caused to adjacent structures, either by falling branches, root plate uplift, or toppling of the tree itself as a result of storm winds.

8.5.2 A probability of occurrence / severity of consequence cross-product matrix approach has been used to assess the risks associated with several different possible events. A copy of the basic assessment matrix is provided below for reference.

Risk Assessment / Quantification Matrix							
Severity	Catastrophic	5	5	10	15	20	25
	Major	4	4	8	12	16	20
	Serious	3	3	6	9	12	15
	Minor	2	2	4	6	8	10
	Negligible	1	1	2	3	4	5
Likelihood			1 Extremely Unlikely	2 Very Unlikely	3 Unlikely	4 Likely	5 Very Likely
<p>1 - 4: ■ Low risk – OK to proceed. No additional controls required.</p> <hr/> <p>5 -18: ■ Medium risk – Corrective control actions or preventative measures required.</p> <hr/> <p>20 - 25: ■ High risk – Do not proceed. Devise and adopt alternative approach.</p>							

Definitions of Likelihood (Probability)			Definitions of Consequences (Severity)				
Very Likely	5	Very likely to occur	Catastrophic	5	Fatality / severe environmental damage / severe property damage.		
Likely	4	Likely to occur	Major	4	Major injury or illness /significant environmental or property damage.		
Possible	3	Could occur	Serious	3	Multiple minor injuries / notable property damage / serious environmental damage.		
Unlikely	2	Unlikely to occur	Minor	2	First aid injury or illness / minor property damage / minor environmental damage.		
Very Unlikely	1	Very Unlikely to occur	Negligible	1	No first aid required / slight property damage.		

8.5.3 Risk of damage to the main Bretton Lodge residential property:

- 8.5.3.1 Possible scenario: Impact from falling branches due to natural dieback:
 Probability: 3
 Severity: 5
 Risk: 15 (Medium risk)
 Action: Regularly cut back suspect branches, or remove the tree.

- 8.5.3.2 Possible scenario: Impact from falling tree due to storm action:
 Probability: 2
 Severity: 5
 Risk: 10 (Medium risk)
 Action: Reduce size of tree to prevent possibility of impact.
- 8.5.4 Risk of damage to the estate wall and outhouse to the west:
- 8.5.4.1 Possible scenario: Impact from falling branches due to natural dieback:
 Probability: 4
 Severity: 5
 Risk: 20 (High risk)
 Action: Remove the tree.
- 8.5.4.2 Possible scenario: Foundation disruption due to root plate uplift:
 Probability: 2
 Severity: 5
 Risk: 10 (Medium risk)
 Action: Remove the tree.
- 8.5.4.3 Possible scenario: Impact damage from branch sway in windy conditions:
 Probability: 5
 Severity: 4
 Risk: 20 (High risk)
 Action: Regularly inspect and cut back impacting branches.
- 8.5.5 Risk of damage to the adjacent property approx. 18m to the west:
- 8.5.5.1 Possible scenario: Impact from falling tree due to storm action:
 Probability: 1
 Severity: 5
 Risk: 5 (Medium risk)
 Action: Reduce size of tree to prevent possibility of impact.
- 8.5.6 Damage to the patio area to the north
- 8.5.6.1 Possible scenario: Impact from falling branches due to natural dieback:
 Probability: 4
 Severity: 3
 Risk: 12 (Medium risk)
 Action: Regularly cut back suspect branches, or remove tree.
- 8.5.6.2 Possible scenario: Disruption due to root plate uplift:
 Probability: 2
 Severity: 3
 Risk: 6 (Medium risk)
 Action: Remove the tree.

8.5.7 It can be seen from the assessment above that a significantly high level of risk is associated with the tree in several of the scenarios that have been considered. Some of the scenarios entail an unacceptable level of risk of damage to the adjacent property if action is not taken to remove the tree.

8.5.8 It is therefore recommended that the existing tree should be carefully removed, and that a replacement specimen tree should be planted in a suitable location where it can grow freely without the possibility of damage to adjacent structures or property.

9.0 Conclusions and recommendations

9.1 The tree is believed to be a sub-mature male Atlas Cedar (*Cedrus Atlantica*), which when fully mature could potentially reach a height of around 20m.

9.2 The tree has suffered asymmetrical branch loss and root plate disturbance due to the recent storms Dudley and Eunice, which caused widespread damage across the UK during the week from 13th to 19th February 2022.

9.3 The tree is now in a partially unbalanced condition as a result of branch loss and damage to the root plate. This makes it more susceptible to toppling by high winds in the future.

9.4 There are medium residual risks of damage to the main Bretton Lodge residential property to the north of the tree.

9.5 There are medium and high residual risks of damage to the estate wall and outhouse to the west of the tree.

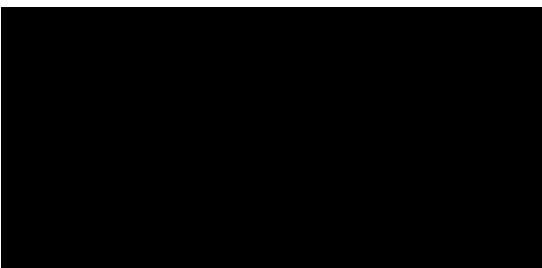
9.6 There is a medium residual risk of damage to the adjacent property approx. 18m to the west of the tree.

9.7 There are medium residual risks of damage to the patio area to the north of the tree.

9.8 It is recommended that the existing tree should be carefully removed, and that a replacement specimen tree should be planted in a suitable location where it can grow freely without the possibility of damage to adjacent structures or property.

Signed:

Date: 6th November 2022



Director
Thisolutions Ltd

Appendix A1:

Photographs



Photo A1.1 : View of the semi-mature Atlas Cedar located to the south-west of the main residential property at Bretton Lodge. NB branch imbalance due to storm damage.



Photo A1.2 : Distinctive male flowers and clustered growth of needle-like foliage of the *Cedrus Atlantica*.



Photo A1.3 : Photo of Bretton Lodge taken in Easter 1998, showing the Atlas Cedar to the left hand side of the property. The estimated height of the tree at the time was 8m.



Photo A1.4 : Current-day view of Bretton Lodge, showing the Atlas Cedar, now estimated to be approx. 15m tall.



Photo A1.5 : Photo taken on 20th February 2022, showing branch loss due to storms Dudley and Eunice.



Photo A1.6 : The Atlas Cedar, viewed from the east.
NB imbalance of branches due to storm damage.



Photo A1.7 : A slight eastward lean of the twin trunks is apparent. This appears to be due to a slight rotational shift of the root plate, due to strong winds from the west.



Photo A1.8 : Slight lifting of major roots to the south and west of the tree, with slight resultant lift in the bed joint coursing of the adjacent estate wall.



Photo A1.9 : The estate wall runs to the western side of the tree, and is of clay brickwork to its eastern face. NB also sandstone flagged patio area to the north of the tree.



Photo A1.10 : Cracking and localised loss of pointing to the western coursed sandstone face of the wall. NB fracturing of individual masonry units does not appear to have occurred.



Photo A1.11 : There is a slight westward lean to the head of the wall opposite to the tree, estimated visually to be approx. 150mm.



Photo A1.12 : The sandstone paving to the patio has lifted slightly, resulting in the loosening of pointing.