# Technical Note: Cubbington Wild Pear Tree

Document no.: C253-ATK-EV-NOT-030-0000035

| Revision | Author | Date | Issued for/Revision details |
|---|---|---|---|
| P02 | Tom Dale/Kat Stanhope | 21.10.15 | For Issue |
| | | | |
| | | | |

# Contents



# List of figures

# 1 Introduction

## 1.1 Terms of reference

1.1.1 HS2 Ltd has requested that Atkins Ltd carry out an assessment of a wild pear (*Pyrus pyraster*) tree near South Cubbington Wood. The tree is approximately 800m to the east of the village of Cubbington at Ordnance Survey Grid Reference SP35309 68268 and would be lost to the Proposed Scheme. HS2 Ltd are seeking guidance on ways to preserve the tree through translocation of the tree and/or propagation from the tree.

## 1.2 Background

1.2.1 The Cubbington wild pear tree has been cited as a champion tree in Warwickshire (Steven Falk, October 2012). A champion tree is one that is the tallest or has the largest trunk girth of its kind in the UK (or a given region).

1.2.2 The Environmental Statement (ES)[1] for the Proposed Scheme valued the pear tree at a district/borough level due to the national scarcity of veteran wild pear trees and due to its status as a champion tree in Warwickshire. The ES reported that the loss of the veteran pear tree will result in a permanent adverse effect on its conservation status which will be significant at a district/borough level. The ES committed to compensation for the loss of the tree in the form of propagation of cuttings (grafting) along with seed collection from the tree to retain the genetic material from the tree. The ES also stated that '*...although a suitable option to try and retain the genetic material will be progressed, success cannot be guaranteed. Taking a precautionary approach to assessment, there could be a residual adverse effect on its conservation status that will be significant at up to a district/borough level. The veteran pear tree is hollow at the base; therefore translocation is extremely unlikely to be successful and is not proposed. The felled pear tree will be moved to the woodland creation area adjacent to South Cubbington Wood to provide deadwood habitat.*'

1.2.3 HS2 Ltd have commissioned a survey of the pear tree to investigate the current health of the tree, the likelihood of success in translocating the tree and whether grafts of the tree can be taken and grown for planting as part of mitigation for the Proposed Scheme.

[1] HS2 London-West Midlands Environmental Statement. DfT November 2013. https://www.gov.uk/government/collections/hs2-phase-one-environmental-statement-documents (CFA17 Offchurch and Cubbington, Volume 2, Section 7 Ecology).

# 2 Methodology

## 2.1 Survey methodology

2.1.1 The tree was inspected on 26th June 2015 by Atkins Senior Arboriculturist Tom Dale (BSc (Hons) Cert Arb L6 (ABC), M.Arbor.A).

2.1.2 In attendance during the survey were Katrena Stanhope (Atkins Associate Director, Ecology) who is managing the ecological inputs for HS2 in CFAs 16 to 22 inclusive and Chris Mills (Civic Trees General Manager). Civic Trees are a specialist tree works contractor that have undertaken the successful translocation of mature trees and provide tree grafting services.

2.1.3 Specific measurements and quantitative data were taken in line with the Veteran Trees Initiative Specialist Survey Method (Fay & de Berker, 1997). Tree inspection was undertaken using a mallet, hand probe, tape measure and Laser Ace 300 surveying system. The tree was assessed in line with the Visual Tree Assessment (VTA) method as developed by Mattheck and Breloer (1994). This method is based on the axiom of uniform stress, whereby a tree will grow in response to environmental stimuli to produce a structure that bears forces evenly across its surface. As such an internal defect, such as decay, would initiate a noticeable change in the stem's shape to accommodate the physical change.

2.1.4 The tree's root zone, root flare and buttressing were inspected visually and, where necessary, using a hand probe. The stem and main scaffold limbs were visually inspected and probed where required to provide appropriate measurements for evaluation. The trees crown, main branch framework and shoot extension were inspected from the ground. Any accessible limb or stem union suspected of having decay or cracks were also probed.

2.1.5 As the pear tree is hollow the assessment of tree health utilised the t/R ratio formulated by Mattheck and Breloer (1994). This theory relies on evaluating the possibility of failure from cross-sectional flattening for trees with full crowns. In engineering terms this type of failure is known as Brazier buckling or thin-walled buckling (Kane et al, 2001). The formula is based on the buckling strength of a cylinder and can be applied as follows: when the ratio t/R is >0.3, where t equals the thickness of sound wood remaining in a stem and R equals the radius of the stem, the tree is unlikely to fail due to the amount of decay in the stem (Mattheck and Breloer, 1994).

## 2.2 Survey Limitations

2.2.1 The tree was inspected from ground level only. The tree was not climbed.

2.2.2 The tree survey data collected was not exhaustive and captured unique details about the tree deemed appropriate for this assessment by the Arboriculturist. The survey did not involve any use of internal decay detection equipment.

# 3 Observations and Analysis

## 3.1 General tree details

3.1.1 The tree is growing as a standard tree set within a mature hedgerow to the east of South Cubbington Wood, a Local Wildlife Site which is on the ancient woodland inventory. A public right of way runs 4m south of the tree. The tree is growing in a rural setting within agricultural land and is visible from surrounding views.

3.1.2 The tree is approximately 170 (+/- 20) years old (Mitchell, Schilling and White, 1994). It is 14m in height and has a stem diameter of 1,178mm (diameter at breast height) with a circumference of 3,700mm measured at 1.3m above ground level. The crown spreads 5m to the north, 4.9m to the east, 7.9m to the south and 7.8m to the west.

3.1.3 The tree has been cited as a champion specimen due to its large girth. This girth measurement exceeds the 2.5m threshold for smaller tree species, set within the girth size categories for age-class and can be classified as an Ancient tree and a True Veteran (Fay, 2007).

3.1.4 The survey results from the Veteran Trees Initiative's Specialist Survey Method (Fay & de Berker, 1997) are provided in Appendix A.

## 3.2 Tree crown

3.2.1 The tree's crown is showing signs of vitality with good leaf coverage for the species and locality with only minor amounts of dead wood recorded, amounting to approximately 2% of the crown area and all dead wood was under 80mm in diameter. The calculated live crown ratio (LCR) of the tree is between 80 and 90% (the LCR is the ratio of the vertical extent (height) of the live crown to the height of the entire tree).

3.2.2 Within the upper crown there are approximately 10 old decayed branch wounds from previous branch failures but no debilitating decay was evident that could compromise the crown structure. However, there is a structural defect[2] present in the crown. The tree splits into three stems from 700mm above ground level. The north stem has grown back through the crown to the south west. The stem flattens at 4m where it comes into contact with the western scaffold limb. This flattening having developed due to the weight of the limb and adaptive growth by the tree to compensate for a loss of strength.

3.2.3 The vitality of the tree's crown implies that the small amounts of dead wood are likely to be attributable to competition for light and not a result of a decline in health. The tree has not entered senescence, a phase in the tree's life where the crown starts to dieback as the tree

[2] A defect being some form of structural or physiological deformity in the tree (i.e. variations from a perceived norm) that could predispose a tree to failure or partial failure.

lacks the energy to support the full crown size. The LCR of 80-90% means the crown of this tree is relatively full, thus increasing the potential for damaging wind loads that can be passed down from crown to trunk to the root plate. This is relevant given the hollow trunk, the progression of decay within this area and the elongated cavities present on the trunk that will have weakened the structural integrity of this tree.

## 3.3 Tree trunk

3.3.1 The tree is growing with a slight lean to the south. There is an elongated cavity 100mm wide between the north and east stems extending down the trees trunk to ground level (see Figure 1). This split is likely to be a result of a previous included bark junction where the union contained a region of bark-to-bark contact between the two stems. The internal structure of such a union usually allows them to be pulled apart more easily than a normal branch union from a main stem.

**Figure 1 - Elongated cavity extending down main stem at union between north and east stems**

3.3.2 This elongated cavity is likely to have been produced due a previous co-dominant union being pulled apart, as this type of branch union has no resistance to tensile stress (pulling) (Lonsdale, 1999). At present it is considered that this cavity has not yet induced a significant full or partial failure of the tree as the crown structure above the wound is currently supporting each other and reducing the wind sway potential of the north and west stems. This seemingly has reduced the wind load stresses being passed down into the trunk that could

initiate such a failure. The cavity is old as noted by the grey/green colour; a fresh wound would be green/white.

3.3.3 There is a cavity on the south side of trunk from ground level to 1.3m (see Figure 2). This cavity revealed that the entire internal circumference of the trunk of the tree is hollow; the void was measured to be 650mm diameter. The rot present being typical of brown rot with a brittle framework of decaying wood and brown dust present. Surprisingly, no wood decay fungi were observed within this area or at any point on the tree.

**Figure 2 - Elongated cavity to 1.3m height above ground level on the south east side of the trunk**

3.3.4 The speed at which the internal decay has progressed is not quantifiable by this assessment. However, using the t/R ratio formulated by Mattheck and Breloer (1994) it would appear the remaining un-decayed wood that is supporting the tree equates to approximately 44% of the trunk's radius, or approximately 264mm in thickness. The significance of this remaining sound wood or 'critical wall' is that a hollow stem with a wall below 30% is much more likely to fail as a result of a buckling or flattening of the cross-section very much like a hose-pipe when it is pushed together (Mattheck & Breloer, 1994).

3.3.5 When analysing this figure one must note that the formula does not take into account other tree defects, such as open cavities that can contribute to a loss in wood strength. The formula is based on a complete cylinder, so the presence of cavities in the trunk also needs consideration as these account for approximately 10% of the stem circumference. Therefore, using Table 4-2 from the F.A. Bartlett Tree Expert Co.'s 'Tree Risk Management Manual' (2007) this tree still sustains over the minimum thickness of sound wood required for a tree not to be considered at high risk of failure, i.e. over 200mm.

## 3.4 Tree base and surrounding soils

3.4.1 The tree is growing within a dry ditch. The buttress roots (the large diameter anchoring roots at the base of the tree) appeared sound, without decay.

3.4.2 No evidence of root plate movement was observed, i.e. the disturbance of adjacent soils.

3.4.3 A large number of suckering stems were recorded at the base of the tree. These stems arise from the roots and are typical of fruit tree species. The surrounding suckering growth could form the basis for propagation material.

3.4.4 Trees, like most plants, form mycorrhizal associations with fungi which live in the soil. These mycorrhizal fungi benefit trees by linking directly with the tree roots and effectively extending their root system as they gather essential nutrients that are otherwise inaccessible to the tree. They also act as barrier to certain disease-causing organisms (Fay, 2008). The ability to preserve this symbiotic relationship with the mycorrhizal fungi is significantly reduced should the tree be excavated from its current location. Disruption or rapid changes to the tree or its surroundings, including the surrounding soils, have been acknowledged during studies on veteran tree management as not producing significant rates of success and have been identified as poor and damaging practices to their continued health (Fay, 2002).

# 5 Conclusions

## 5.1 Translocation

5.1.1 The current health or vitality of the tree is good with minimal dead wood in its crown and no foliar defects were recorded, i.e. mottled or chlorotic leaf coverage. This full healthy crown is good in as much as providing the trees' system with stored and kinetic energy reserves to enable it to continue to live in its existing environment. However, this full crown has a large wind loading capacity which is recognised as the principal cause of the failure of hollow trees, meaning the risk of full or partial failure is increased for this tree. At present, it appears the remaining sound wood within the trunk of the tree is capable of supporting the tree in its current location. If the tree is moved, there will be a change in wind dynamics experienced by its crown which is highly likely to increase the risk of failure, especially with the trunk cavities present.

5.1.2 As the tree has grown over to one side, there would also be a requirement to carry out a heavy crown reduction to attempt to balance the crown. By doing this, the original characteristics of the tree would be lost. There is also concern that the tree would collapse when a lift was attempted due to the structural strength of the stem.

5.1.3 Any large scale pruning would reduce the physiological function of the tree through the removal of a large volume of sapwood that will lead to a significant loss of energy storage capacity within the tree inducing stress conditions. As a result of the stress the tree will be more susceptible to the ingress of disease and is unlikely to actively respond to pruning. The effects of which are exacerbated within ancient trees given their age which means any pruning would need to consider cycles of treatment spread over a sufficiently long time to be gradual and effective, otherwise a rapid change to the tree or its surroundings could lead to physiological stress and subsequent decline. A period of 10 years is, in the opinion of the Arboriculturist, a suitable time frame, reducing the crown after three year increments with the final year to enable the tree to respond to the last pruning operations before any movement.

5.1.4 The British Standard 4043:1989 Recommendations for transplanting root-balled trees specifies a number of pre-lifting operations for transplanting trees including the provision of periodic root pruning operations to prepare the tree for moving. These operations would be expected to take a minimum of two years to achieve, over two growing seasons.

5.1.5 The location of the tree would cause access issues for the move and there would be the need to provide a trackway to allow access for a crane into the field to lift the tree. There would also be issues with getting a suitable sized lorry into the field to move the tree to its new location. Although cost is not a key factor for the decision, the costs and effort involved in translocation, given the location and structural health of the tree and the timescales required to prepare the tree prior to relocation, would be disproportionate given the low likelihood of success. Therefore, it is concluded that the tree is not suitable for translocation.

## 5.2 Propagation

5.2.1 Propagation through the taking of cuttings from live growth on the tree or at its base is the best course of action for preserving the genetic makeup of this tree.

5.2.2 Civic Trees confirmed that a grafting service could be provided for the Cubbington pear tree. Ideally they would take 20 samples to graft onto healthy root stock and maintain these for a minimum of five years.

# 7 References

British Standards Institution. (1989*). BS4043:1989 Recommendations for Transplanting root-balled trees. London: BSI.*

Falk, S. (2012). Tree-hunting in Warwickshire, British Wildlife, volume 24, no. 1., August, pp 21-30.

Fay, N. (2002). Notes on Arboricultural Techniques for Veteran Trees. Available from Treework Environmental Practice website at http://www.treeworks.co.uk/press_releases_publications.php

Fay, N (2007) Defining and surveying veteran and ancient trees. Available from Treework Environmental Practice website at http://www.treeworks.co.uk/downloads/publications/DEFINING_AGE_AND_SURVEYING_VETERAN_AND_ANCIENT%20TREESa.pdf

Fay, N. (2008). Ancient and Veteran Trees 'Data collection and management opportunities in the New Forest National Park'. Available from Treework Environmental Practice website at http://www.treeworks.co.uk

Fay, N. & de Berker, N. (1997). *Specialist Survey Method*. Veteran Trees Initiative, English Nature. Peterborough.

Lonsdale, D. (1999) *The principles of tree hazard assessment and management.* DETR and Forestry Commission, Highways Agency: London.

Mitchell, A.F., Schilling, V. E. And White, J.E.J. (1994). *Champion trees of the British Isles*. Forestry Commission Technical Paper 7. Forestry Commission, Edinburgh.

Smiley, E.T, Fraedrich, B.R. Hendrickson, N and Percival, G (2007). Tree risk management (2nd edition). FA Bartlett Tree Expert Company, Inc.

# Appendix A: Tree Survey Results

| Data set | Recorded information |
|---|---|
| 1. Date of Survey | 26th June 2015 |
| 2. Name of recorder | Thomas Dale, Senior Arboriculturalist, Atkins Ltd |
| 3. Site Address | Cubbington, Warwickshire |
| 4. Tree Grid ref | SP35309 68268 |
| 5. Ownership | Confidential |
| 6. Photograph taken | Yes, refs 001-002, included within the report. |
| 7. Public Access | Partial access, tree can be seen from nearby footpath. |
| 8. Visibility | Yes, visible to pedestrians using the public right of way |
| 9. Site type / setting / Individual tree | Hedgerow tree, rural setting on the edge of an agricultural field. |
| 10. Tree ref number | T001 |
| 11. Protection Status | Unknown |
| 12. Tree species | Wild Pear (*Pyrus pyraster*) |
| 13. Age class | Ancient >2.5m girth at 1.3m |
| 14. Veteran status | True veteran due to qualifying girth size |
| 15. Height (m) | 14m |
| 16. Crown Spread (m) | N-5, E-4.9, S-7.9m, W-7.8 |
| 17. Stem girth at 1.3m (m) | 3.7m stem (diameter at breast height of 1,178mm) |
| 18. Tree form | Maiden, i.e. free grown with unmodified natural control |
| 19. Standing / fallen | Leaning to south, no evidence of root plate lifting |
| 20. Crown form | Full |
| 21. Vitality | Good |
| 22. % Live form of crown extents | 98% |
| 23. Hollowing trunk or stems | Yes – base of trunk, i.e. lowest third of trunk from ground level, and south stem from 1.6m to approximately 2m.<br><br>Base of trunk – entire circumference, with basal cavity. Internal measurement of 650mm diameter.<br><br>South stem – no cavity present to enable measurement of internal hollowing dimensions. |
| 24. Tears / Scars / lightening strikes | No |

| Data set | Recorded information |
|---|---|
| 25. Cavities or water pockets | No |
| 26. Split limbs | No |
| 27. Rot sites | No |
| 28. Deadwood branches or stems | No deadwood attached or fallen over 150mm diameter. Deadwood limited to <100mm diameter |
| 29. Bark condition | Live |
| 30. Bark sapruns | No |
| 31. Fungi | None seen |
| 32. Tree Epiphytes | None seen |
| 33. Signs of animal activity | Yes, potential for mammals using main stem as habitat, with cavity providing entrance point. |
| 34. Compaction of root area | Public right of way 4m south of tree |
| 35. Cultivation close to tree | Yes, agricultural field 6m north and 6.8m south of tree base |
| 36. Fire damage / vandalism | No |
| 37. Grazing damage around base of tree | No |
| 38. Competition / level of shade | Yes, adjacent hedgerow 5m high, shading lower north canopy |
| 39. Past management | Yes, small diameter pruning wounds in crown from past selective limb reductions |
| 40. Remedial works | Recommend PiCUS sonic tomorgraph survey |
| 41. Protection requirements | None identified |