AT2 Tree Surveys

Tree Survey

and

Arboricultural Method Statement

for the

Royal Central School of Speech & Drama

Belsize Park

1st August 2024

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BSi 5837:2012

Contents

Introduction

AT2 was instructed by Allan Joyce Architects to prepare a tree report with reference to the plans to redevelop the Norman Collins Building at the Royal Central School of Speech and Drama. This report describes the methods to be deployed to ensure minimum impact to the retained trees.

The report includes the following sections:

- Context of the report including the following considerations:
    - Tree physiology and potential for damage
    - The importance of protecting trees during construction
    - Trees subject to statutory controls
    - Trees and wildlife
    - Implementation of tree works
    - Design considerations
- Tree survey – provides an objective catalogue of the species, size and condition of the trees on or adjacent to a site. The results of the tree survey inform the design options.
- Arboricultural impact assessment – identifies and evaluates the direct and indirect impacts on existing trees that may arise as a result of the implementation of the design proposal.
- Arboricultural method statement – details of methodologies to be implemented in order to protect the retained trees through each stage of the development.
- Appendices
    A. Glossary of arboricultural terms
    B. Site guidance notes
    C. Bibliography & references

Arboricultural terms that are included in the glossary in appendix B will be appear in **bold** on the first occasion of their use.

Considerations

Damage to Trees[2]

Trees that have good health and stability are well adapted to their surroundings. Any development activity which affects the adaptation of trees to a site could be detrimental to their health, future growth and safety. Tree species differ in their ability to tolerate change but all tend to become less tolerant after they have reached maturity or suffered previous damage or stress. Planning and subsequent site management should aim to minimise the effect of change.

The part of a tree most susceptible to damage is the root system, which, because it is not immediately visible, is frequently ignored. Damage to, or death of the root system affects the health, growth, life expectancy and safety of the entire tree. The effects of such damage may only become evident several years later. Damage may be the result of a number of insignificant but compounding factors that accumulate over time.

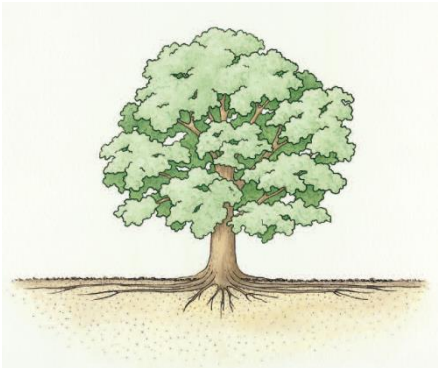
Damage to the stem and branches of a tree is not usually sufficient to kill the tree directly but may make it unsafe by affecting the weight of distribution of the crown or by facilitating decay in the long term. Such damage may also be disfiguring.

Roots perform several functions:

- Anchoring the tree in the ground
- Taking up water and minerals from the soil
- Storing food for times of dormancy

Roots grow predominantly near the soil surface – 90% or more of all roots, and virtually all of the large structural supporting roots, are within 60cm of the surface of the ground. Although they may be deeper within the dense mass of roots and soil close to the base of the tree it is uncommon for roots to penetrate to a depth greater than 2 metres[7].

Within a short distance of the stem the roots are highly branched so as to form a network of small-diameter woody roots that typically extend radially for a distance much greater than the height of the tree, except where impeded by unfavourable conditions. All parts of this system bear a mass of fine, non-woody absorptive roots.



Trees have relatively shallow but wide spreading roots[6].

The root system does not generally show the symmetry seen in the branch system. Roots proliferate wherever they encounter favourable soil conditions which is why the greatest root concentration is found close to the soil surface where the soil is loosest, and water, oxygen and nutrients are most readily available. As far as these conditions allow, the root system tends to develop sufficient volume and area to provide physical stability.

The uptake of water and mineral nutrients by the root system takes place via the fine roots, typically less than 0.5 mm diameter. Their survival and functioning - which are essential for the health of the tree as a whole - depend on the maintenance of favourable soil conditions. The fine roots are short-lived with the majority dying each winter and with fresh ones developing in response to the needs of the tree.

All parts of the root system, but especially the fine roots, are vulnerable to damage. Once roots are damaged, water and nutrient uptake is restricted until new ones have grown. Mature and over-mature trees respond slowly, if at all, to damage of their woody roots.

The main risks to tree roots come from physical damage and compaction to the surrounding soil.

- Physical damage:

  During construction damage is often sustained when digging foundations or trenches for services. Surface roots are at risk when laying driveways, hardstanding and landscaping. Damaged roots are an entry point for infection and if a root is cut completely the tree loses a proportion of its capacity to take up water and minerals, store energy for the winter and weakens its anchorage in the ground.

Walnut roots smashed by an excavator.

- Compaction:

  This is often caused by vehicular traffic. Tree roots need oxygen to respire and growth is inhibited or stopped when the airspaces in the soil are lost through compaction.

- Other damage:

  Trees can also be damaged by contamination from fuel and chemical spillages or by fires.

Unless the damage is extremely severe it is unlikely that a tree will show symptoms immediately. More typically there is a steady decline over a few years with smaller leaves, crown dieback and possibly, eventual failure.

Protection of trees during construction

BS5837: 2012 Trees in relation to design, demolition and construction - Recommendations[2] gives guidance on the implementation of protection for trees and roots before and during construction.

Recognising the importance of root health, the British Standard defines the **root protection area (RPA)** as:

> *the minimum area around a tree deemed to contain sufficient roots and rooting volume to maintain the tree's viability, and where the protection of the roots and soil structure is treated as a priority.*

The RPA is calculated as an area equivalent to a circle with a radius 12 times the stem diameter measured at a height of 1.5m above ground level. Any modifications to the shape of the RPA should only be made based on a sound arboricultural assessment of likely root distribution.

The tree survey schedule on page 13 gives the radius of the RPA for each tree. This is the minimum distance at which barriers should be stationed to protect trees and their roots to form a **construction exclusion zone (CEZ)**.

Trees subject to Statutory Control

Local Planning Authorities may assess trees as beneficial to the wider community in terms of their amenity value. They may protect such trees with a Tree Preservation Order (TPO). Work may still be permitted on protected trees but permission for the works must first be obtained from the LPA.

Some areas are designated conservation areas. Before carrying out works on a tree in a conservation area notice must be given to the LPA. The LPA can either allow the works to proceed or impose a TPO.

Where felling would produce more than five cubic metres of timber a felling license may be required from the Forestry Commission. However, this does not apply to trees growing in an orchard, garden, churchyard or public open space.

Trees and Wildlife

Trees are hosts to nesting birds and mammals. Under the Wildlife and Countryside Act it is an offence to disturb any nesting bird or bat. Before carrying out any works it is important to ensure that there are no birds or bats in residence.

Implementation of Tree Works

Tree work is skilled and potentially dangerous. Work should be carried out by trained and certificated contractors working to BS 3998: 2010 *Recommendations for Tree work*[1].

Design considerations

The default position should be that structures are located outside the RPAs of trees to be retained[2]. However, where there is an overriding justification for construction within the RPA, technical solutions might be available that prevent damage to the trees such as pile and beam foundations and permeable geocells.

The relationship of buildings to large trees can cause apprehension to occupiers or users of nearby buildings or spaces, resulting in pressure for the removal of the trees. Buildings and other structures should be designed and/or sited with due consideration given to the trees' ultimate height and

canopy spread. The design should take into account future growth so as to reduce the need for frequent remedial pruning or other maintenance.

Shading and light penetration should also be considered when positioning windows and indoor and outdoor living spaces to allow sufficient natural light. This survey does not include any shade assessment although it is possible to model the shade cast by tree canopies at different times of the day and year.

Where permanent hard surfacing within the RPA is considered unavoidable, new hard surfacing should be gas and water permeable and should not require excavation into the soil ("**no-dig**"). BS5837 recommends that new hard surfacing should not exceed 20% of any existing unsurfaced ground within the RPA[2].

Early consultation and collaboration regarding the planning of utility runs is recommended so that underground services can be combined in a single trench that avoids the RPA.

To fulfil their potential, trees need to reach maturity. Many newly planted trees fail to survive the first two years due to inadequate ground preparation and lack of aftercare. In some studies, after 22 years only 42% had survived, putting long-term canopy cover and ecological service targets at risk.

Environmental legislation is evolving. The Environment Act 2021 and the Town and Country Planning Act set targets for biodiversity net gain whilst the NPPF (National Planning Policy Framework) sets the objective of sustainable development including:

- Existing trees are retained wherever possible (paragraph 136)
- New streets are tree-lined, opportunities are taken to incorporate trees elsewhere in developments and that appropriate measures are in place to secure the long-term maintenance of newly-planted trees (paragraph 136)
- Opportunities to improve biodiversity in and around developments should be integrated as part of their design. (paragraph 186.d)

Fastigiate oaks and planes on a Dutch street.

Over the long-term, larger, long-lived trees have lower annual maintenance costs and give much greater benefit. Where practical, landscape design should diverge from the limited palette of cherry, birch and rowan and consider varieties of larger species. A diverse mix of planting will help provide resilience against future pests and diseases. Guidelines recommended that the mix contains no more than 30% from the same family, 20% from the same genus and 10% of the same species.

Retaining mature trees may also increase property values. Several studies have shown that average house prices are between 5% and 18% higher where property is associated with mature trees (NUFU 2005).

The Trees & Design Action Group publishes a number of free guides designed to facilitate a better understanding of the range of returns that trees offer new developments and how to secure these returns.

Arboricultural constraints related to BS5837 grading

The survey schedule on page 13 includes a tree quality assessment grading in accordance with BS5837. Trees are graded as A, B, C or U in accordance with the assessment cascade chart on page 15.

- Trees identified as category A are those of high quality with an estimated remaining life expectancy of at least 40 years. These trees are particularly good examples of their species or of particular visual importance as arboricultural and/or landscape features. They pose a significant constraint to development and should be retained, protected and incorporated within the design where possible. Category A trees are shaded green on the tree plan.

- Trees identified as category B are those of moderate quality with an estimated remaining life expectancy of at least 20 years. These are trees that might be included in category A, but are downgraded because of impaired condition (e.g. presence of significant though remediable defects, including unsympathetic past management and storm damage). They also pose a significant constraint to development and should be retained, protected and incorporated within the design where possible. Category B trees are shaded blue on the tree plan.

- Trees identified as category C are those of low quality with an estimated remaining life expectancy of at least 10 years. These are unremarkable trees offering low or only temporary/transient landscape benefits. They are in an adequate condition to be retained but could be replaced by new planting. Category C includes young trees with a stem diameter below 150mm which are not yet of a size to make a significant contribution to the landscape. These trees should not be considered to pose a significant constraint to development but should be retained and protected where possible. Category C trees are shaded grey on the tree plan.

- Trees identified as category U are those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years. This includes trees that have a serious structural defect, trees that are dead or are showing signs of significant overall decline and very low-quality trees suppressing adjacent trees of better quality. These trees are unsuitable for retention and should not be a constraint to development. Category U trees are shaded red on the tree plan.

N.B. Biodiversity net gain (BNG) scores trees according to their ecological value which may conflict with the BS5837 gradings. Low quality trees graded C or U may have high ecological value and score highly for BNG.

Tree Survey

Methodology & limitations

The trees were inspected from ground level to produce a catalogue of species, size and general condition and their longer-term value. The soil was not examined and no samples were taken for analysis. There has been no attempt to assess potential root damage or subsidence potential.

The content of the tree survey should be used to inform the design options. It is not intended to be used as a detailed tree risk management survey. Trees are living organisms whose health and condition can change rapidly and no guarantee can be given as to the absolute safety or otherwise of any tree. The report may include some recommendations to reduce the likelihood of tree failure but absolute safety is not a realistic goal; even apparently sound trees can fail, particularly during extreme weather – best practice recommends that trees are inspected every 18 months when they are alternately in and out of leaf[13].

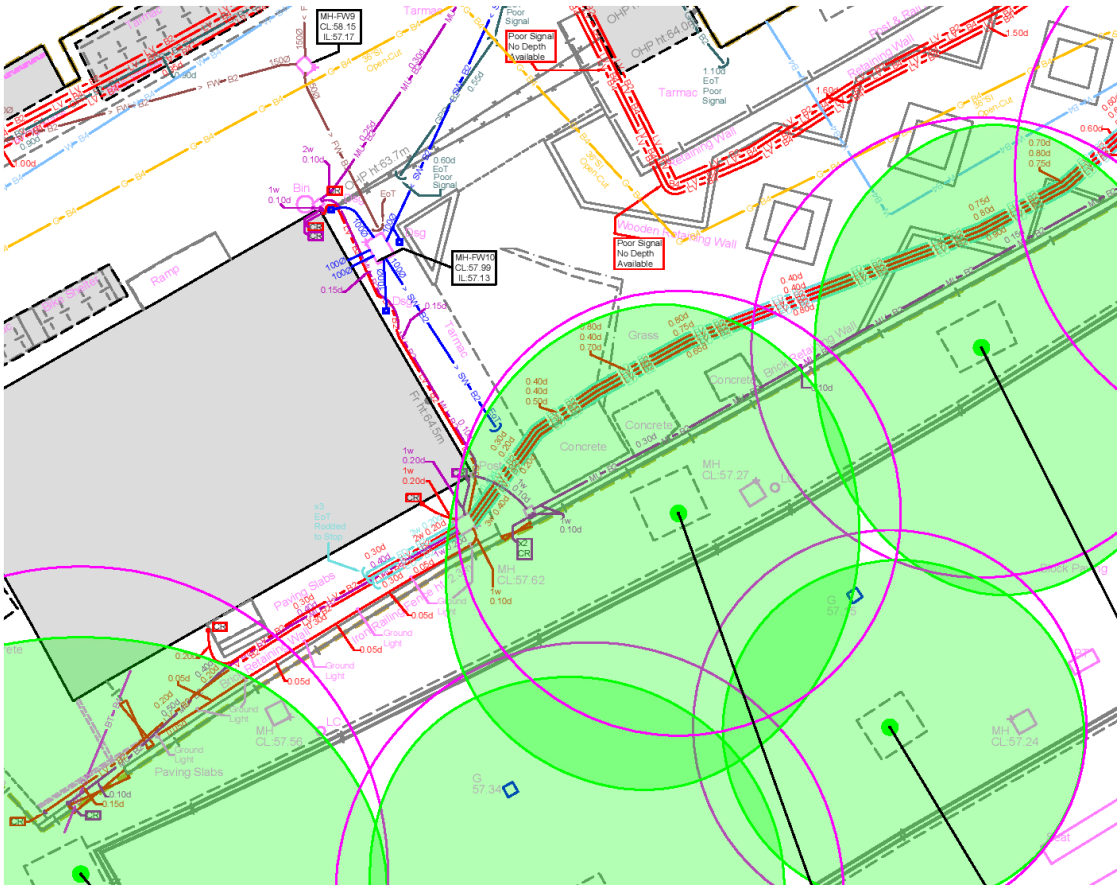
The position of the trees on the plan on page 12 is not intended to infer ownership which should be clarified before any tree work is carried out.

Site description

View looking northwest from Eton Avenue.

The school is situated on the north side of Eton Avenue which, at this point, is pedestrianised and lined with plane trees. The Camden Council website shows that the school is partially within the Belsize Park conservation area. A tree plan is included on page 12 showing canopies shaded in accordance with their BS5837 categories and their root protection areas coloured magenta. At the time of the visit the weather was fine and sunny.

The underground survey shows a complex network of utilities including gas, electricity, communications and drainage.



Section of plan showing underground utilities.

View looking southwest from inside the site.

Recorded information

The following details were recorded for each tree and tabulated in the survey schedule:

- Tree plan ID; G prefix denotes group of trees.
- Species; Common name and *botanical name.*
- Height in metres measured using a Nikon 550 Forestry Pro hypsometer.
- Girth and diameter measured at 1.5 metres above ground level (# denotes estimated measurement where trunk is inaccessible; typ. ⇒ typical value).
- Whether the tree has a single or multiple stems.
- The calculated radius in metres for the **root protection area** (shown in magenta in the tree survey plan on page 12).
- The cardinal spread of the crown in metres.
- Canopy height in metres (ground clearance).
- The height in metres to the crown break (height of the lowest branches on the main trunk).
- The life stage:
    - Young: establishing, usually with good vitality but as yet of limited significance in the landscape.
    - Semi-mature: established, normally vigorous, increasing in height and of increasing landscape significance.
    - Early-mature: established; approaching mature height with crown spreading.
    - Mature: fully established trees around the middle of their typical life expectancy; generally retaining good vitality and achieving full height but their crowns still spreading.
    - Over-mature: fully established trees toward the end of their typical life expectancy with declining vitality.
    - Ancient: surviving beyond the typical age range for the species. Very old with low vitality and liable to decline. May include important Veteran Trees.
- Physiological and structural condition including the presence of physical defects and decay.
- Estimated remaining contribution in years.
- Tree quality assessment grading in accordance with BS5837:2012 (see page 15).

For expediency some trees may have less detail recorded and, in some cases, similar trees may be grouped for the purposes of this survey.

Tree Survey Plan

Shaded outline shows tree canopy graded in accordance with BS5837; RPA shown in magenta. The position of the trees is not intended to infer ownership which should be clarified before any tree work is carried out. This tree plan is also supplied as an AutoCAD dwg file, XREFerenced to the topographical model. The tree geometry including the canopy and RPA are stored as layers that can be easily imported and overlaid onto a design layout to produce a tree constraints plan. Note: the CAD drawing units are metres.

Plan ID	Species	Height (m)	Girth (cm)	Diameter (m)	No. of Stems	RPA radius (m) (Area m²)	Spread (m)	Canopy height (m)	1st sig. branch hght/dir	Life stage Physiol. cond. Structural cond.	Observations, notes & recommendations	Remaining contribution (years)	BS5837 Grading
T1	Silver birch *Betula pendula*	5	46	0.15	1	1.8 (10)	N 1.5 E 1 S 2 W 1.5	1.5	2	Semi-mature Good Good		10+	C2
G2	Mixed shrubs	2	0		1		N E S W			Mature Good Good	Tree of heaven, cotoneaster, viburnum, cordyline, choysia, berberris, escalonia.	10+	C2
T3	London plane *Platanus x hispanica*	22	289	0.92	1	11.0 (383)	N 8.5 E 11 S 10 W 11	4	4.5	Mature Good Good		40+	A2
T4	London plane *Platanus x hispanica*	22	209	0.67	1	8.0 (200)	N 7.5 E 6.5 S 10 W 8.5	4	4.5 W	Mature Good Good		40+	A2
T5	London plane *Platanus x hispanica*	22	216	0.69	1	8.3 (214)	N 8 E 7.5 S 9 W 6	4	4.5 N	Mature Good Good		40+	A2
T6	London plane *Platanus x hispanica*	23	267	0.85	1	10.2 (327)	N 10 E 9 S 7 W 5	4	3.5	Mature Good Good		40+	A2
T7	London plane *Platanus x hispanica*	22	226	0.72	1	8.6 (234)	N 8 E 9 S 11.5 W 5	4	4	Mature Good Good		40+	A2
T8	Cut leafed alder *Alnus glutinosa 'Imperialis'*	3	20	0.06	1	0.8 (2)	N 2 E 1 S 2 W 2	2	2	Young Fair Fair		10+	C2
T9	London plane *Platanus x hispanica*	22	224	0.71	1	8.6 (230)	N 7.5 E 9.5 S 11 W 9	4	4 W	Mature Good Good		40+	A2

Plan ID	Species	Height (m)	Girth (cm)	Diameter (m)	No. of Stems	RPA radius (m) (Area m²)	Spread (m)	Canopy height (m)	1st sig. branch hght/dir	Life stage Physiol. cond. Structural cond.	Observations, notes & recommendations	Remaining contribution (years)	BS5837 Grading
T10	London plane *Platanus x hispanica*	12	186	0.59	1	7.1 (159)	N 3.5 E 4 S 3 W 3.5	5	4	Mature Good Poor	Ganoderma fungal brackets around root collar. Condemned by Camden Council and scheduled for removal.	<10	U
T11	London plane *Platanus x hispanica*	16	202	0.64	1	7.7 (187)	N 4 E 5.5 S 5 W 4	6.5	4.5	Mature Good Good		40+	A2
T12	London plane *Platanus x hispanica*	19	185	0.59	1	7.1 (157)	N 6 E 7 S 6.5 W 6	5.5	5.5 W	Mature Good Good		40+	A2
T13	London plane *Platanus x hispanica*	18	239	0.76	1	9.1 (262)	N 8 E 7 S 7 W 8	3	4	Mature Good Good		40+	A2
T14	False acacia *Robinia pseudoacacia*	8	62	0.20	1	2.4 (18)	N 4.5 E 4 S 4 W 5	2	2	Early-mature Good Good		40+	A2

BS 5837:2012 Cascade chart for tree quality assessment

AT2 Tree Surveys

Category and definition	Criteria (including subcategories where appropriate)			Identification on plan
	Trees unsuitable for retention (see Note)			
Category U Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years	• Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category U trees (e.g. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning) • Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline • Trees infected with pathogens of significance to the health and/or safety of other trees nearby, or very low-quality trees suppressing adjacent trees of better quality *NOTE Category U trees can have existing or potential conservation value which it might be desirable to preserve*			Red
	1 – Mainly arboricultural qualities	**2 – Mainly landscape qualities**	**3 – Mainly cultural values, including conservation**	
Trees to be considered for retention				
Category A **Trees of high quality** with an estimated remaining life expectancy of at least 40 years	Trees that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups or formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue)	Trees, groups or woodlands of particular visual importance as arboricultural and/or landscape features	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e.g. veteran trees or wood-pasture)	Green
Category B **Trees of moderate quality** with an estimated remaining life expectancy of at least 20 years	Trees that might be included in category A, but are downgraded because of impaired condition (e.g. presence of significant though remediable defects, including unsympathetic past management and storm damage), such that they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality	Trees with material conservation or other cultural value	Blue
Category C **Trees of low quality** with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits	Trees with no material conservation or other cultural value	Grey

Arboricultural Impact Assessment (AIA)

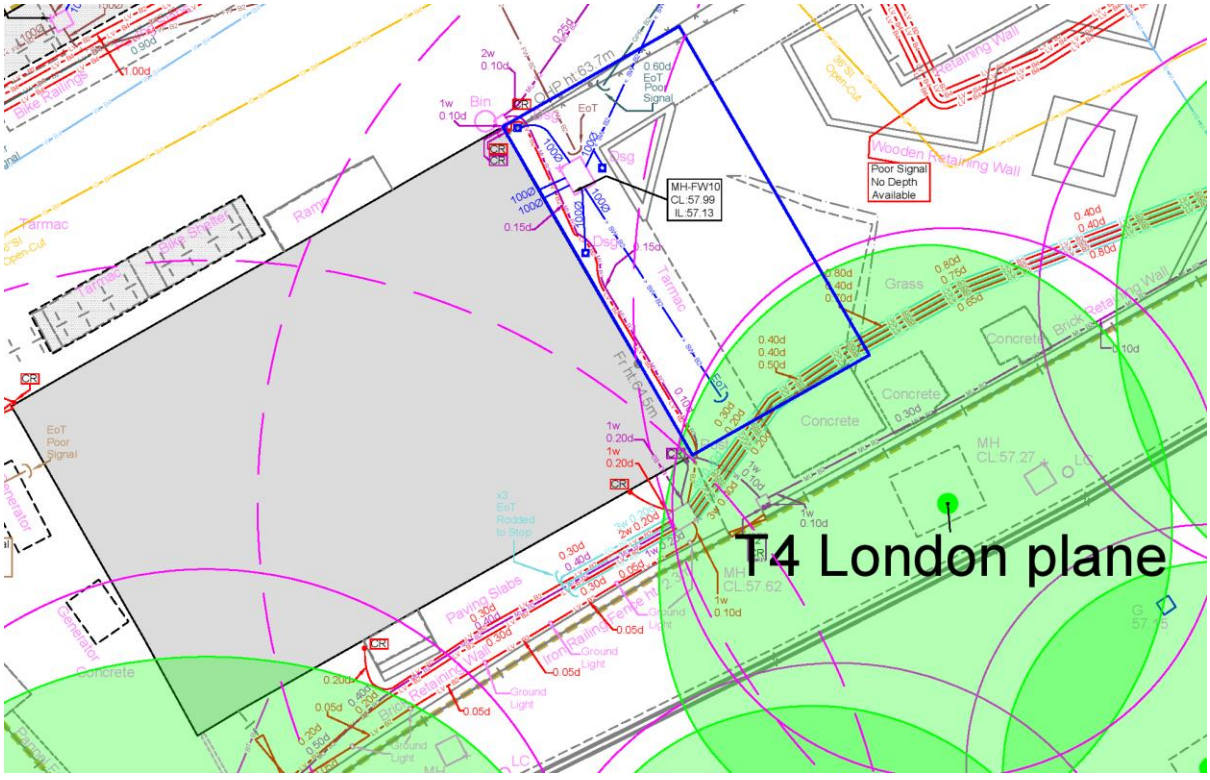
Impact of the development on the trees

All the trees will be retained.

Whilst the nominal root protection areas are shown as circles in accordance with BS5837, the actual root morphology is likely to be much more complex due to the following factors:

- The area is almost entirely paved with very little open ground.
- The foundations of the existing Norman Collins building will have influenced root growth.
- There are concrete blocks just to the north of T4
- There are numerous underground utilities below the site.

Despite these challenges, the plane trees evidently have access to sufficient soil rooting volume to maintain large and healthy canopies. It is likely that the roots will have exploited soil loosened during the excavation of service trenches and also the planting area within the site. Root growth will have been opportunistic and is likely to be very asymmetric. Consequently, all roots within 20 metres of any tree should be considered to be significant to the health of the tree. The extended root protection areas are shown as dashed circles and encompass much of the site and all of the extension footprint.



Existing buildings shaded grey with black outline and proposed extension outlined in blue. Nominal root protection areas shown as solid magenta circles and extended RPA as dashed.

To minimise the impact on roots, foundations will be constructed using specially engineered pile and beam/slab.

The canopy of T4 overhangs the proposed extension and limited target pruning may be required to accommodate the building.

Measures to minimise damage to the retained trees are detailed in the arboricultural method statement below.

Impact of the trees on the development

The design takes into account the size, position and future growth of the trees relative to the property to minimise issues of shading, seasonal nuisance, frequent remedial pruning or future pressure for removal. Whilst the trees will continue to grow in height and spread, tree maintenance for the extended building will be same as the periodic pruning required to maintain clearance from the existing building.

Arboricultural Method Statement (AMS)

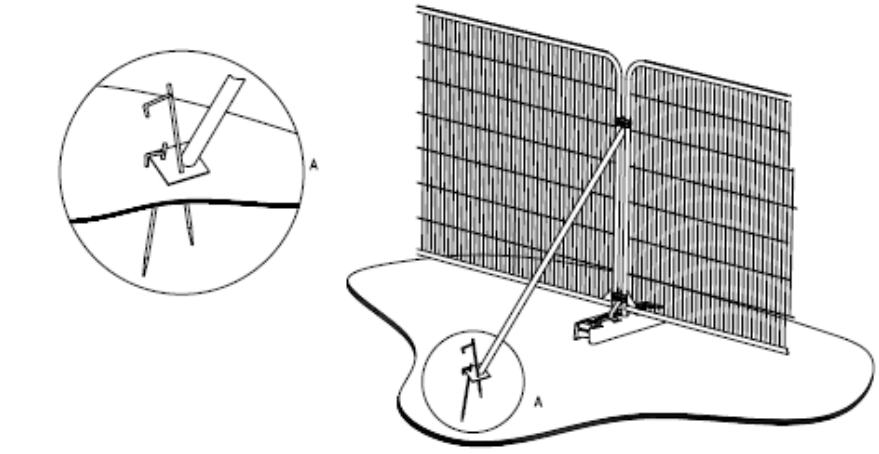
Pre-development tree work

Prior to commencement of construction the London plane T4 will be pruned to facilitate clearance for the extended building and associated access. All works will be carried out in accordance with BS3998: 2010. The tree contractor will carry out checks for nesting birds and bats. The disposal of brash and other arisings will be agreed with the client.

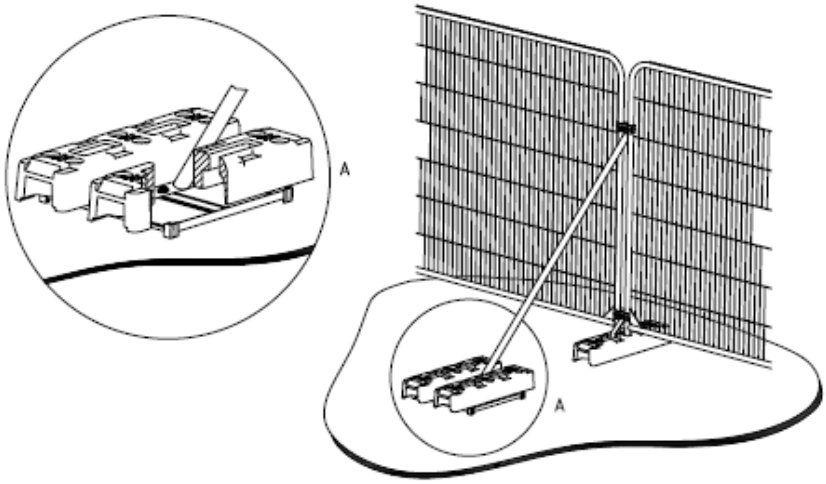
Construction exclusion zones

Before any development commences, protective barriers will be installed to protect the trunks and lower limbs of the trees and to constrain construction traffic to the existing hard surfaces. The position for the barrier is shown in an A1 size 1:100 scaled tree protection plan *"Central School of Speech and Drama, London AIA-A1 TPP.pdf",* a section of which is shown overleaf. The radius of the RPA for each tree is shown in the Survey Schedule and on the tree protection plan. Due to surveying limitations, discrepancies may exist in the relative position of features on the plan, therefore all measurements for RPAs should be taken directly from the trees themselves.

Examples of suitable protective barriers are shown below.



a) Stabilizer strut with base plate secured with ground pins



b) Stabilizer strut mounted on block tray

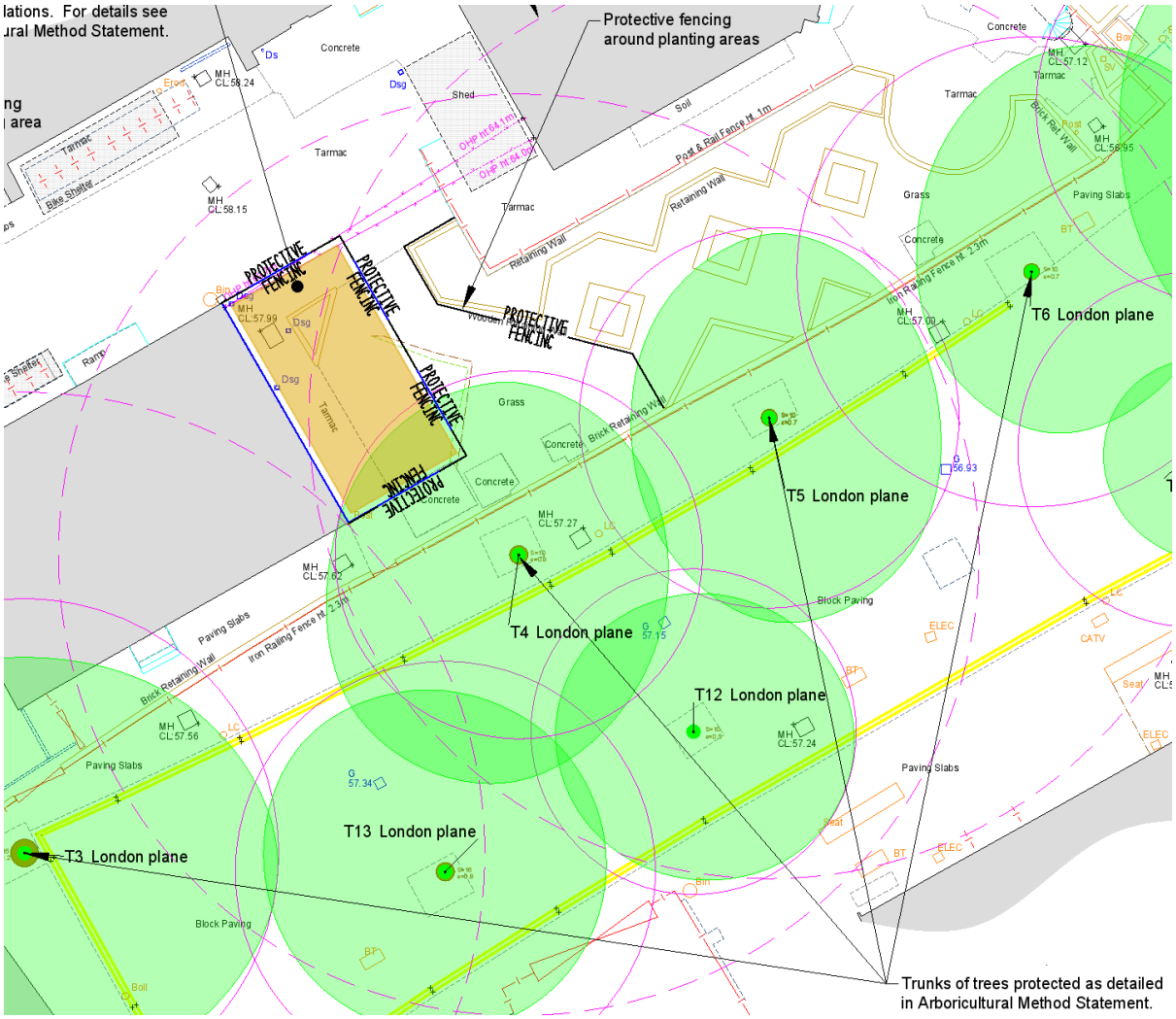
Protective Barrier (British Standard 5837: 2012)

The barrier will have all-weather notices attached with words such as:

"CONSTRUCTION EXCLUSION ZONE – NO ACCESS".

All barriers will remain in place until completion of all works.

Further guidance can be found by following the link for *Fencing protected trees* on page 29.



Extract from the tree protection plan showing siting of protective fencing.

The plane trees are outside of the site boundary but will be vulnerable to impact from delivery and contractors' vehicles. The trunks will need to be protected whilst maintaining pedestrian access along the pavement. Before any development commences, protection will be installed for the trunks of four closest trees. Other trees may also need protecting depending on arrangements for construction access. Protection will consist of lengths of timber fastened around a compressible layer such as hessian sacking and surrounded by a rigid wooden panel box as shown in the examples below. The wooden box will be approximately 1.5 metres square and fixed to the timber lengths but not to the tree itself.

Examples of trunk protection.

Removal of existing foundations

The foundations of the existing property will be retained but structures including the concrete blocks will be removed to accommodate the extended footprint. The concrete will be carefully broken up using a breaker, lifted and removed taking care not to damage any roots that may be below. Working backwards from the edges of the concrete, machinery may drive on the concrete but will not be permitted to run on unprotected soil surfaces below. This method is sometimes referred to as "top down, pull back". To avoid damaging branches, machinery must not be operated under the canopy of any tree unless closely supervised by a banksman. These works will be carried out under the supervision of a qualified arboriculturalist.

No roots of more than 25mm in diameter will be severed as they may be critical for the health and stability of the tree.

As the concrete and hard surfacing is removed, screened, BS3882 certified, multipurpose topsoil will be used to cover any exposed roots.

To avoid contamination and compaction, demolition spoil will not be stored within 10 metres of the trees or on any unprotected soil surfaces.

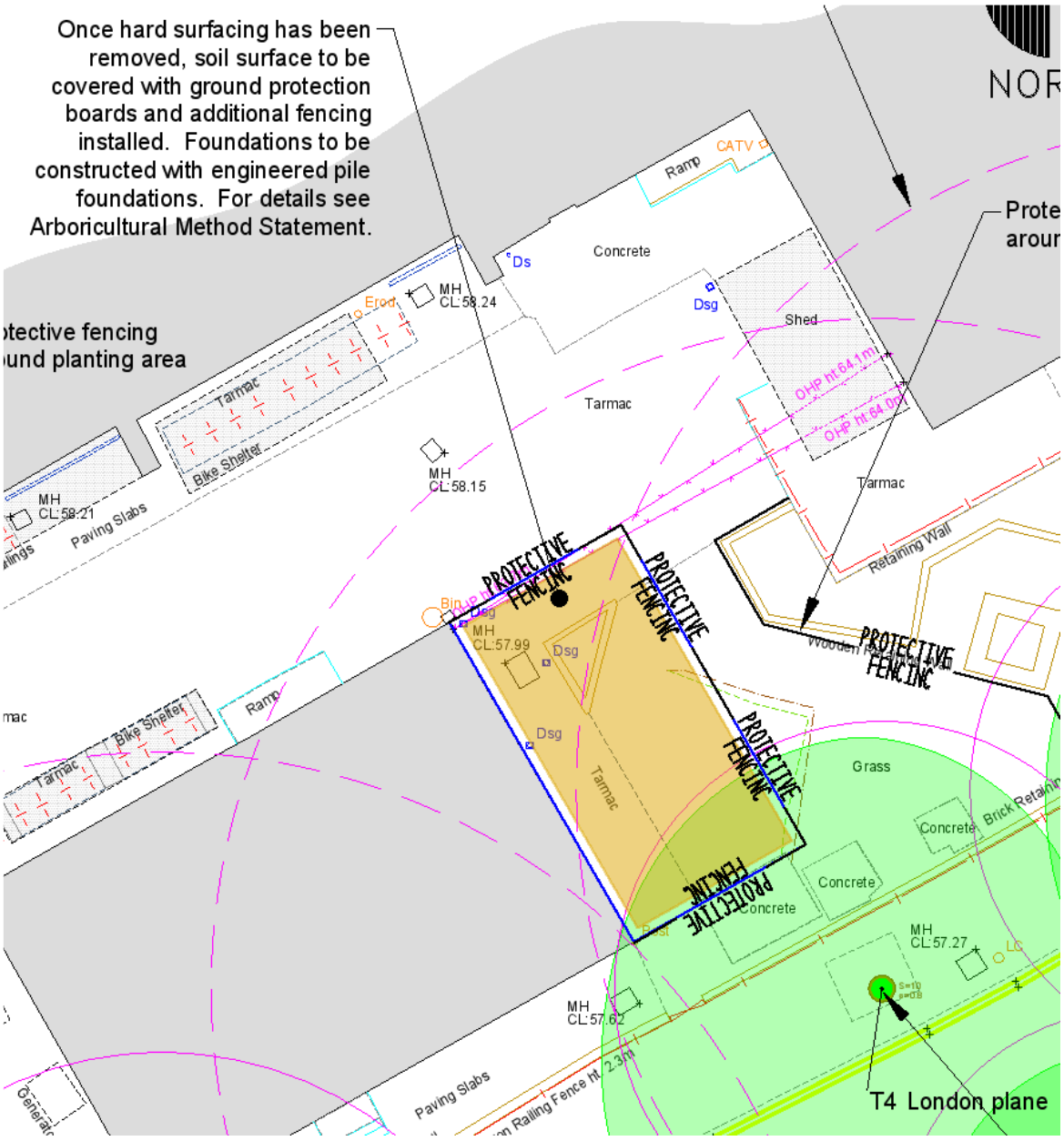
Further guidance can be found by following the links for *Excavation in root protection areas* and *Removing surfacing and structures in root protection areas* on page 29.

Ground protection

As removal is completed, additional fencing will be installed around the exposed soil and ground protection will be installed within the building footprint as shown in the tree protection plan extract included below. Boards will be placed 30cm from the face of the wall. Ground protection will consist of inter-linked 20mm wooden boards or scaffolding boards placed on top of a 100mm compression-resistant layer of woodchip or sharp sand, laid onto a geotextile membrane. Builders' sand will not be used because of its high salt content, which is toxic to tree roots. Ground protection

will also be installed to cover any exposed soil surfaces outside of the footprint where concrete or hard surfacing has been removed.

Ground protection will remain in place until completion of the build unless replaced earlier with flooring or hard surfacing (see plan extract below).



Details of ground protection from tree protection plan.

An A1 size, fully scaled tree protection plan is available with reference *"Central School of Speech and Drama, London AIA-A1 TPP.pdf"*

Further guidance can be found by following the link for *Ground protection* on page 29.

Foundation construction

To minimise future risk of subsidence and/or heave, the foundations will be constructed in accordance with NHBC Standards Part 4 (2021). *Chapter 4.2 Building near trees*[3].

Much of the building will occupy the existing footprint and it may be possible to reuse the existing foundation but the extended slab will require specially engineered foundations to avoid damage to the roots below.

Once the concrete and hard surfacing has been lifted and the ground protection installed as described above, explorations will be made using an air-spade to establish the size, position and depth of roots together with services and other below-ground structures. Depending on the findings, the foundations might include slabs or beams supported or cantilevered off piles or pads. The detailed foundation design will be specified by a structural engineer.

Air-spade trenching.

Within the building footprint, ground protection and protective fencing will be removed as the floor is installed. Perforated pipe will be laid under the building to redistribute the rainwater from the roof and irrigate the roots below.

Due to the highly alkaline leachate produced during the curing of wet concrete, concrete will not be poured within the root protection area (RPA) unless an impermeable liner has been installed.

Further guidance can be found by following the links for *Installing structures in root protection areas* and *Site cranes and piling rigs* on page 29.

Routing of services

Early consultation and collaboration regarding the planning of utility runs is recommended.

Services will be connected to the existing service runs and any new services will be routed either outside of the RPA or by using trenchless techniques such as moling or air-spading.

Further guidance can be found in the National Joint Utilities Group - Volume 4: *Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees*[4] and by following the link for *Installing services in root protection areas* on page 29.

Hard surfacing

All new hard surfacing within the RPA will be constructed using “no-dig” methods and will be gas and water permeable.

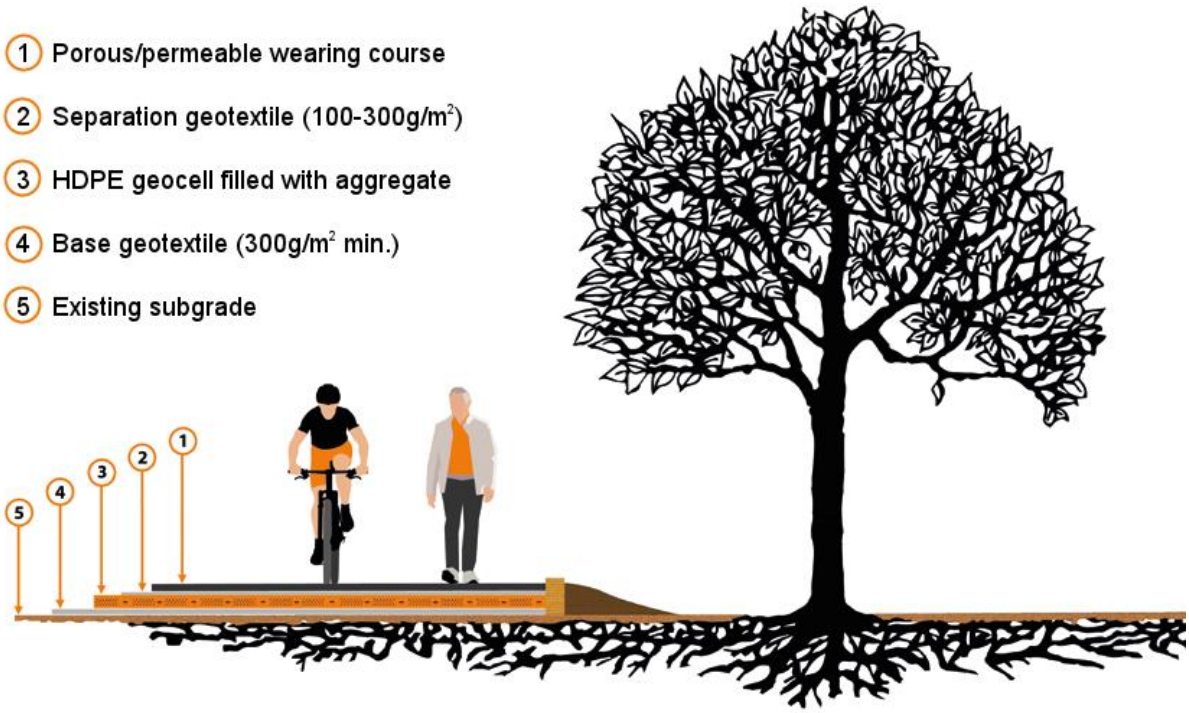
Guidance can be found in Guidance Note 12: *The Use of Cellular Confinement Systems Near Trees: A Guide to Good Practice*[5] from where the following key points have been taken.

The three principles of no-dig construction are:

- Roots must not be severed.
- Soil must not be compacted.
- Oxygen must be able to diffuse into the soil (and carbon dioxide out of the soil) beneath the engineered surface.

A cellular confinement system is a series of geocells arranged in a honeycomb-like formation that is combined with an underlying geotextile and angular stone to spread loads in such a way as to minimise compaction of underlying soil. Wearing surface options include porous asphalt, permeable block paving and loose or resin-bound gravel.

When cellular confinement systems or 'geocells' are used to protect tree root zones the central concept is that they are installed above ground and this normally results in a surface that is around 150mm above the existing ground level for footpaths, and in excess of 300mm above for roads and driveways. Careful consideration may need to be given to matching the raised level with existing surfaces and a sectional drawing can be useful.



The basic approach to using cellular confinement systems for ground protection near trees[5].

A suitably qualified technician should specify the appropriate depth of geocell to use and this will depend on the bearing capacity and the strength of the soil.

The design should not require excavation into the soil but if there are no obvious surface roots the removal of up to 50mm of the turf layer or any other surface vegetation may be removed. A tracked excavator with a toothless grading bucket is normally the best machine to use to remove the turf layer because this creates an even surface. For this application excavators should be of an appropriate size for delicate works (i.e. ≤5 tonne). Ground preparation works using excavators in root protection areas must be supervised by an arboriculturist to make sure that significant roots (single roots >25mm diameter or clusters of roots 10–25mm in diameter) are preserved and to ensure that vehicles are being used appropriately.

It is important to prevent compaction within the RPA during the geocell installation. This can be achieved either by carrying out work progressively from the newly-laid surface or by installing a temporary, non-compressible protective layer over the RPA.

If the geocell surface needs to be used as an access road during construction, its installation should be one of the first tasks the contractor carries out. In some circumstances it may be necessary to install additional protection above the geocell during the demolition/construction phase. This may be required to prevent soil compaction by heavy vehicles during the development process, or as a temporary alternative to the final wearing course which might otherwise be damaged during the work. If a temporary wearing course is not used there is also a risk that mud could sink into the stone aggregate which would reduce its long-term permeability and effectiveness in maintaining gaseous exchange with the soil.

In most situations overfilling the geocells with 50−75mm of material could be a suitable solution for temporary protection but for long-term construction projects additional temporary protection would be required. Options for temporary surfacing include ply boards (for light use), heavy-duty plastic sheets, metal road plates, or a temporary sacrificial geocell layer over the surface. The latter approach is preferred as it is more likely to maintain porosity and permeability – a central concept to maintaining a healthy soil environment beneath.

A crucial and often overlooked aspect of installing geocells is the interface between the surface laid on geocell sub-base and adjacent surfaces that have been laid on a conventional sub-base. Often the tree root zone is circular, and the intended hard surface is to cover a larger area than the sensitive root zone, and so it is tempting to only specify a geocell sub-base for the sensitive area. However, it is much easier to install surfacing in larger discrete blocks, and the final surface is likely to be much more durable if any interfaces between different surfaces are considered in the design. Therefore, it is advised that geocell is used beneath the full width of the surface rather than just part of it. The interface between different sub-bases can be incorporated within the design so that differential movement will not cause a crack to appear between the two different surface types. In order to achieve this an interface can be hidden at a point where the surfacing naturally changes (e.g. between a car-parking space and an access drive).

There are several proprietary geocell systems that allow pedestrian and vehicular surfaces to be laid within the RPA. Further details can be obtained from companies including Geosynthetics Cellweb and Terram Geocell. Selection of the geocell supplier is a commercial decision. Suppliers have technical specialists that can assist with the development of the geocell specification including the surface finish and the (no-dig) edging.

Further guidance can be found by following the link for *Installing/upgrading surfacing in root protection areas* on page 29.

Other measures

- The construction exclusion zone leaves a very constrained working and storage area. The phasing of deliveries will need to be carefully managed to ensure there is adequate space to receive materials.
- To avoid contamination and compaction, no materials will be stored within 5 metres of a tree trunk or on any unprotected soil surfaces. This includes building materials, scaffolding, fuel, site huts and temporary toilets.
- No mixing or storage of materials will take place up a slope where they may leak down into an RPA. Where the contours of the site create a risk of harmful spillages running into RPAs, precautionary measures such as sandbags and heavy-duty plastic sheeting will be installed to prevent contamination. (see also link to *Pollution control* on page 29)
- Due to the highly alkaline leachate produced during the curing of wet concrete, concrete will not be poured within the root protection area (RPA) unless an impermeable liner has been installed.
- Notice boards will not be attached to any part of a tree and no fires will be allowed within 10 metres of the canopy or the protective barrier of any retained tree.
- Screw piles are preferred for any fencing installed within the RPA of any tree. Initially the post holes must be carefully dug by hand and positioned so that no roots greater than 25mm in diameter are severed. As above, post-fixing concrete will not be used unless an impermeable liner has been installed.

Sequence of works

1) Pre-development tree work to remove trees identified in the Arboricultural Impact Assessment (AIA).
2) Installation of protective fencing and ground protection to establish construction exclusion zones.
3) a) Removal of concrete and hard surfacing.
   b) Installation of additional fencing and ground protection.
4) Site development including routing of services and installation of hard surfacing.
5) Removal of protective fencing.

Monitoring

The main contractor will be responsible for:

- Monitoring of all operations with regard to tree protection on site.
- Maintaining the integrity of all tree protection measures.
- Keeping a copy of the tree protection plan on site for reference during construction and for the induction of staff and contractors.
- The compliance of sub-contractors.
- Ensuring that the planning conditions attached to the planning consent are adhered to at all times.
- Further guidance can be found by following the link for *Monitoring protection* on page 29.

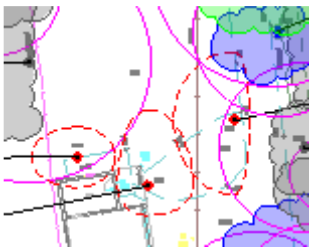
Appendix A – Glossary of arboricultural terms

Access facilitation pruning

One-off tree pruning, without significant adverse impact on tree physiology or amenity value, which is directly necessary to provide access for operations on site.

Arboricultural impact assessment (AIA)

Study to identify and evaluate the direct and indirect impacts on existing trees that may arise as a result of the implementation of a site layout proposal.



Arboricultural method statement (AMS)

Details of methodologies to be implemented in order to protect the retained trees **(see also tree protection plan (TPP)**).

Codominant stems

Codominant stems occur when a tree grows with two or more main stems or 'leaders' that are about the same diameter and emerge from the same location on the main trunk. The bark for each stem is trapped inside the fork preventing them from fusing together. This may also be referred to as a compression fork.

The presence of codominant stems with included bark reduces the strength of the union and therefore increases the risk of failure under loading during strong winds[15].

However, the presence of included bark does not mean the tree will fail. Codominant stems are a common feature of many trees and most will live to the end of their natural life without a problem. The decision whether to take remedial action should take a range of factors into consideration including the size, position and condition of the tree and the proximity of 'targets' close to the tree.

Construction exclusion zone (CEZ)

An area based on the **RPA** to be protected during development by the use of barriers and/or ground protection to ensure the long-term retention of a tree.

Crown lifting

The removal of lower branches and/or parts of pendulous upper branches to provide clearance over roads and paths and allow more light under a tree or into nearby property.

Work specified as a clearance height above ground level.

Crown reduction

The cutting back of branches to reduce the overall size of a tree's canopy. Crown reduction should seek to retain the tree's natural form and a flowing branch line without leaving stumps.

Work specified as a reduction in height and radial width and/or annotated photographs.

Drop crotch pruning

Removing a portion of a branch or stem by cutting back to a lateral branch which is at least 1/3 of the diameter of the section that is being removed.

Epicormic growth

Bushy shoots growing directly from the trunk arising from adventitious or dormant buds.

Formative pruning

Pruning of young trees to produce a good shape and prevent future management problems.

Hanger

A broken branch lodged or hanging in the canopy.

No-dig construction

With reference to foundations, hard surfacing and utilities, the design should not require excavation into the soil, including through lowering of levels and/or scraping, other than the removal, using hand tools or an air-spade, of any turf layer or other surface vegetation.

Pile and beam foundation

Type of foundation where mini-piles or screw piles are bridged with concrete and/or steel beams and the floor suspended using block and beam construction with a vented void below. The underside of the beams is at or just above ground level. Often used where conventional strip foundations would cause unacceptable root damage.

Pollarding and Coppicing

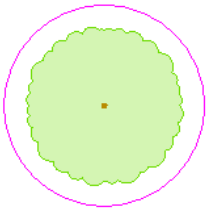
The removal of all or nearly all of a tree's branches and foliage. Pollarding is generally only appropriate on trees where the practice has been long established and carried out regularly such as willow, lime and plane.

A framework pollard removes all the smaller branches but leaves a framework of major limbs.

With coppicing trees or shrubs are cut close to ground level and allowed to regenerate.

Root protection area (RPA)

The minimum area around a tree deemed to contain sufficient roots and rooting volume to maintain the tree's viability, and where the protection of the roots and soil structure is treated as a priority (shown in magenta in the tree survey plan on page 12).



Ruderals

A ruderal species is a plant species that is first to colonize disturbed lands such as construction sites.

Sucker growth

Similar to epicormic growth but suckers shoot from the roots of the parent tree.

Target pruning

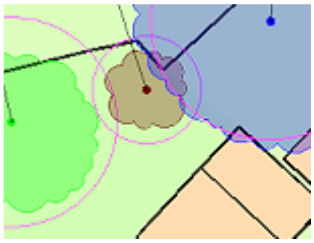
Pruning to create or maintain clearance from buildings, street lights, guttering, aerials, etc.

Topographical survey

An accurate depiction of an area of land which is scaled and detailed to show all the natural and manmade features and their levels.

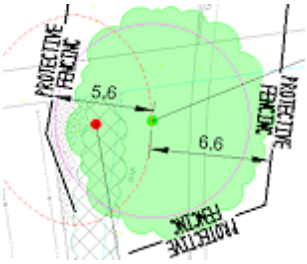
Tree constraints plan (TCP)

Scale drawing showing the canopy and RPA of the trees overlaid onto the layout scheme to highlight potential conflict. The TCP may include shading modelling.



Tree protection plan (TPP)

Scale drawing showing finalised layout, tree retention and tree protection measures detailed in the **arboricultural method statement (AMS)**.



Appendix B – Site guidance notes

Barrell Tree Consultancy has produced a series of site guidance notes that give more detail on specific elements of the management of trees on construction sites. They can be downloaded using this link to their website or by using the QR codes or links below.

1. Monitoring protection
   https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn01/
2. Fencing protected trees
   https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn02/
3. Ground protection
   https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn03/
4. Pollution control
   https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn04/
5. Site cranes and piling rigs
   https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn05/
6. Height restrictions
   https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn06/
7. Excavation in root protection areas
   https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn07/
8. Removing surfacing and structures in root protection areas
   https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn08/
9. Installing/upgrading surfacing in root protection areas
   https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn09/
10. Installing structures in root protection areas
    https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn10/
11. Installing services in root protection areas
    https://www.barrelltreecare.co.uk/resources/technical-guidance/sgn11/
12. Landscaping in root protection areas
    https://www.barrelltreecare.co.uk/ resources/technical-guidance/sgn12/

Appendix C – Bibliography & References

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