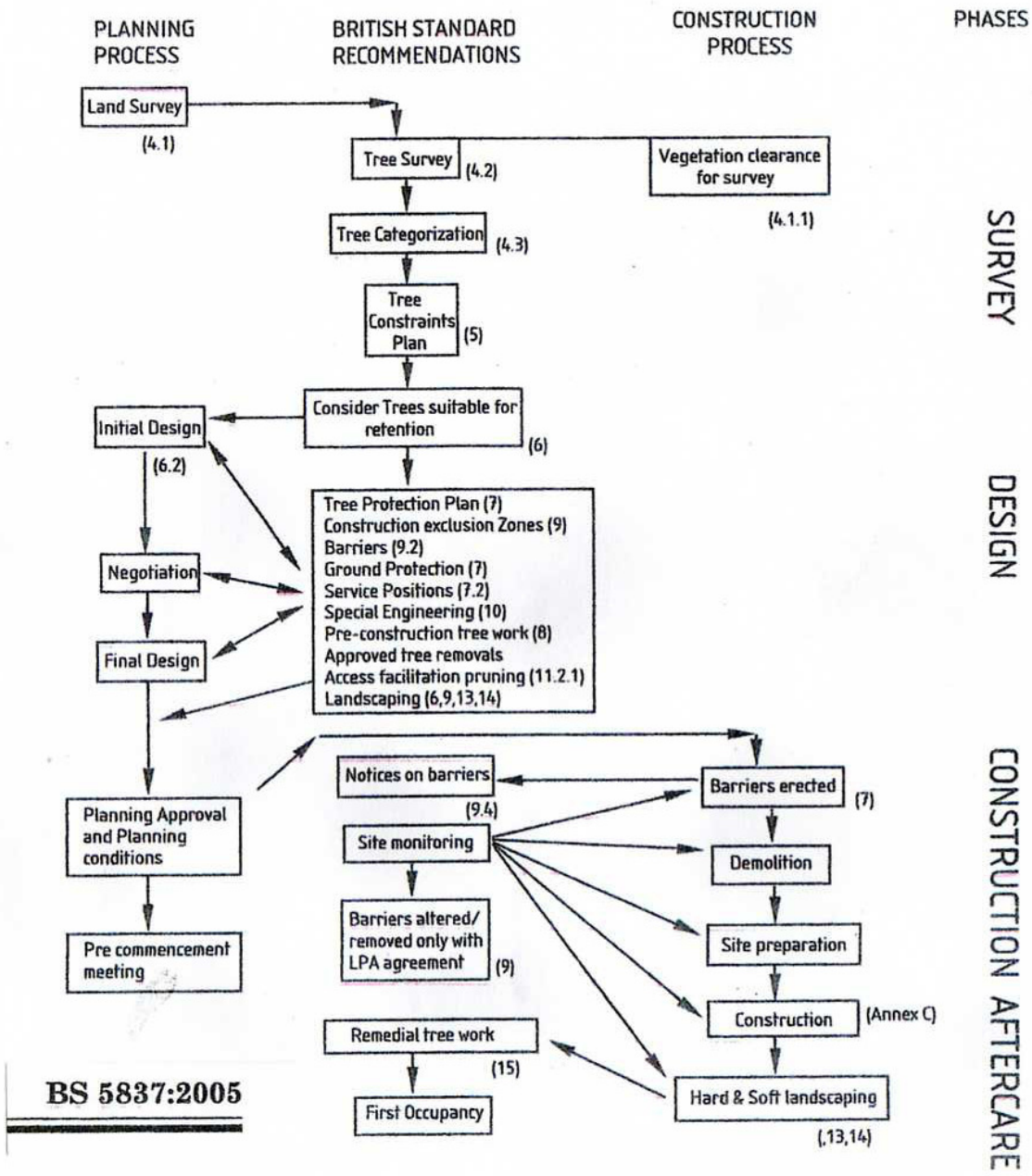
Bernie Harverson
arboricultural consultant

BH 1

Tree Survey Schedule
(in accordance with Table 1 of BS5837)
+ Tree Survey Notes + Flow Diagram

Bernie Harverson
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Figures in brackets refer to Clause numbers.

Figure 1 — Flow diagram, summarizing planning for trees on development sites

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TREE SURVEY NOTES

These Tree Survey Notes have been prepared in accordance with the recommendations of **British Standard 5837:2005** and define the criteria for pre – development tree surveys.

- Each tree/group has been allocated a unique number (**No.**). Where specifically commissioned small durable numbered metal tags can be applied to each tree/group surveyed.
- The tree species (**Species)** is provided in both English and Latin formats.
- Height assessments (**Ht**) are estimated in metres. This will be adequate for the majority of cases, but where accurate heights become a critical issue it may be necessary to return to site, as a separately commissioned exercise, to collect accurate measurements with the aid of optical instruments.
- Trunk/stem diameters (**Trunk Diam**)are measured in millimetres at 1.5m above ground level and denoted as **S** single stemmed trees or **M** for multi-stemmed trees which are measured immediately above the root flare.
- Radial crown spread assessments (**Brch Sprd**) are estimated in metres from the centre of the trunk/group to each of the four primary points of the compass (**N-**north**; E-**east**; S-**south and **W-**west) in order to achieve a representation of the crown shape which will be recorded on the accompanying tree survey plan. These provide a general guide as to the main bulk outline of a tree/groups crown but are not tape measured dimensions. These would only be undertaken as part of a separately commissioned exercise, where precise dimensions are critical to the project at hand.
- The average ground clearance (**Grd Cl**) is estimated and shown in metres.
- An assessment of a tree/groups age (**Age)** class is made in terms of its site specific maturity as part of the surrounding landscape, taking into account its overall shape and form in that setting, and is recorded thus :-

  Y - Young tree/group
  MA - Middle – aged tree/group
  M - Mature tree/group
  OM - Over – mature tree/group
  V - Veteran tree/group
- An assessment of a tree/groups overall physiological condition (**Fm**)is recorded as :-

  G - Good
  F - Fair
  P - Poor
  D - Dead
- Data on the structural condition (**Condition Comments)** of the tree/group is provided to give an indication of its visual appearance and any significant health and safety issues.
- Details of necessary tree works required at the time of survey is given under the heading – **Preliminary Management Recommendations**
- An estimate of a tree/groups future life expectancy (**Rem Cont)** is made and is recorded thus :-
  1-10; 10-20; 20-30; 30-40 or **>40** years**.**
- The category grading (**Cat)** for each tree/group is assessed according to the criteria provided within **BS5837:2005.** The assessment is made of the tree/group in its current condition and within the environment encountered bearing in mind its suitability for retention as part of any future proposed development; although the exact layout detail of any specific scheme will not be known at the time of surveying. The trees have been classified into one of four categories and colour coded as BS5837 recommends - R (dark red); A (light green); B (mid-blue) and C (grey).Please note that the numerical sub-categories which are also applied are for guidance only and do not carry any cumulative or increased value for the tree/group. This colour coding scheme will be applied to all drawings provided.

Table 1 – Cascade chart for tree quality assessment

TREES FOR REMOVAL				
Category and definition	**Criteria**			**Colour on plan**
Category R Those in such a condition that any existing value would be lost within 10 years and which should, in current context, be removed for reasons of sound arboricultural management.	• 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 **R** category trees (i.e. 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 (e.g. Dutch Elm Disease), or very low quality trees suppressing adjacent trees of better quality			**Dark Red**
TREES TO BE CONSIDERED FOR RETENTION				
	Criteria – Subcategories			
	1	**2**	**3**	
Category A – Those of high quality and value: in such a condition as to be able to make a substantial contribution (a minimum of 40 years is suggested)	Trees that are particularly good examples of their species, especially if rare or unusual, or essential components of groups, or of formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue)	Trees, groups or woodlands which provide a definite screening or softening effect to the locality in relation to views into or out of the site, or those of particularly visual importance (e.g. avenues or other arboricultural features assessed as groups)	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e.g. veteran trees or wood-pasture)	**Light Green**
Category B – Those of moderate quality and value: in such a condition as to make a significant contribution (a minimum of 20 years is suggested)	Trees that might be included in the high category, but are downgraded because of impaired condition(e.g. presence of remediable defects including unsympathetic past management and minor storm damage)	Trees present in numbers, usually as groups or woodlands, such that they form distinct landscape features, thereby attracting a higher collective rating 3than they might as individuals but which are not, individually, essential components of formal or semi-formal arboricultural features (e.g. trees of moderate quality within an avenue that includes better, A category specimens), or trees situated mainly internally to the site, therefore individually having little visual impact on the wider locality	Trees with clearly identifiable conservation or other cultural benefits	**Mid Blue**
Category C – Those of low quality and value: currently in adequate condition to remain until new planting could be established (a minimum of 10 years is suggested), or young trees with a stem diameter below 150mm	Trees not qualifying in higher categories	Trees present in groups or woodlands, but without this conferring on them significantly greater landscape value, and/or trees offering low or only temporary screening benefit	Trees with very limited conservation or other cultural benefits	**Grey**
Note: Whilst **C** category trees will usually not be retained where they would impose a significant constraint on development, young trees with a stem diameter of less than 150mm should be considered for relocation				

Bernie Harverson arboricultural consultant

BJH.0388

TREE SURVEY SCHEDULE

Client : **158 Hart Plain Avenue Ltd.**

Site Location : **Brewmaster PH, 158 Hart Plain Avenue, Waterlooville**

Surveyors : Bernie Harverson *M.Arb.* **Original Survey :** 17th November 2009

Re-Surveyed : **14th March 2011**

No	Species	Ht m	S or M	Trunk Diam mm	Brch Sprd m	Grd Cl m	Age	F	Condition Comments	Preliminary Management Recommendations	Rem Cont yrs	Cat
Grp 1	English Oaks *x3 of*	16	S / M	520 to 760	N7 E7 S7 W7	2	M	F	Epicormics-crown shape dictated by group pressure-merged crowns-some deadwood and stubs-previously crown lifted to 4m-previously pruned to clear roof of pub	No work considered essential at time of survey	>40	B2
G1a	Pedunculate Oak *Quercus robur*	14	S	520	N1 E9 S9 W7	2	M	F	Suppressed to the north-crown shape dictated by group pressure-merged crowns-previously crown lifted to 6m-old pruning wounds failed to occlude	No work considered essential at time of survey	>40	B1
G1b	Pedunculate Oak *Quercus robur*	16	S	500	N7 E5 S2 W5	1	M	F	Epicormics-suppressed to the south-crown shape dictated by group pressure-merged crowns	No work considered essential at time of survey	>40	B1
G1c	Sessile Oak *Quercus petraea*	15	M	760	N8 E9 S1 W1.5	2	M	P	Very large fungal bracket of *Ganoderma applanatum – Heart Rot Fungus* attached on west side-bifurcated at 1m above ground level-suppressed to the south and west-crown shape dictated by group pressure-merged crowns	Advise decay detection exercise to determine the extent of the internal decay	10-20	C1
Grp 2	Pedunculate Oaks *x 2 of*	14	S	400 to 550	N7 E7 S7 W7	2	MA	F	Base and trunk smothered in ivy -crown shape dictated by group pressure-merged crowns-major deadwood and stubs-low branching habit	No work considered essential at time of survey	>40	C2

G2a	Pedunculate Oak *Quercus robur*	13	S	400	N8 E3 S0 W7	2	MA	P	Significant bark wounds on south side close to ground level-100m of soft decay-suppressed to the east and south-crown shape dictated by group pressure-merged crowns-major deadwood and stubs-tarmac damaged by root action	No work considered essential at time of survey	>40	C1
G2b	Pedunculate Oak *Quercus robur*	14	S	550	N2 E9 S8 W7	2	MA	P	Base and trunk smothered in ivy-suppressed to the north-crown shape dictated by group pressure-merged crowns-major deadwood and stubs-tarmac damaged by root action	No work considered essential at time of survey	>40	C1
Grp 3	Pedunculate Oaks *x3 of*	19	S / M	340 to 1000	N10 E7 S7 W8	2	M	P	Crown shape dictated by group pressure-merged crowns-deadwood throughout	No work considered essential at time of survey	>40	C2
G3a	Pedunculate Oak *Quercus robur*	19	S	530	N10 E6 S0 W0	2	M	P	Close grown with T3b and trunks entwined at ground level-bifurcated at 5m above ground level	No work considered essential at time of survey	30-40	C1
G3b	Pedunculate Oak *Quercus robur*	18	S	420	N5 E2 S4 W6	2	M	P	Close grown with T3a and trunks entwined at ground level-low crown density-minimal live crown area	No work considered essential at time of survey	30-40	C1
G3c	Pedunculate Oak *Quercus robur*	18	S	350	N0 E4 S6 W6	2	M	P	Low crown density-minimal crown area-small diameter deadwood throughout	No work considered essential at time of survey	>40	C1

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BH 2

Tree Root Protection Area Schedule

(in accordance with Table 2 of BS5837)

Bernie Harverson
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BJH.0388

ROOT PROTECTION ZONE/AREA SCHEDULE

Client : 158 Hart Plain Avenue Ltd.

Site Location : Brewmaster PH, 158 Hart Plain Avenue, Waterlooville

Tree No.	Tree Species	Grade	Single or Multi Stem	Diam. mm	BS5837:2005 Table2- Radial Protect. Zone m	BS5837:2005 Table2- Root Protect. Area m^2	Is An Offset Required To Cater For Existing Rooting Pattern Restrictions
Grp 1	Pedunculate Oaks *x3 of*	n/a	n/a	n/a	n/a	n/a	See individual assessments below
G1a	Pedunculate Oak *Quercus robur*	B1	S	520	6.3	122.4	NO – there are pressures all around this tree which cancel each other out
G1b	Pedunculate Oak *Quercus robur*	B1	S	500	6.0	113.1	NO – there are pressures all around this tree which cancel each other out
G1c	SessileOak *Quercus petraea*	C1	M	760	7.6	181.5	NO – there are pressures all around this tree which cancel each other out
Grp 2	Pedunculate Oaks *x 2 of*	n/a	n/a	n/a	n/a	n/a	See individual assessments below
G2a	Pedunculate Oak *Quercus robur*	C1	S	400	4.8	72.4	NO – there are pressures all around this tree which cancel each other out
G2b	Pedunculate Oak *Quercus robur*	C1	S	550	6.6	136.9	NO – there are pressures all around this tree which cancel each other out
Grp 3	Pedunculate Oaks *x3 of*	n/a	n/a	n/a	n/a	n/a	See individual assessments below
G3a	Pedunculate Oak *Quercus robur*	C1	S	530	6.4	127.1	NO – fairly free rooting to all directions

G3b	Pedunculate Oak *Quercus robur*	C1	S	350	4.2	56.0	NO – fairly free rooting to all directions
G3c	Pedunculate Oak *Quercus robur*	C1	S	420	5.0	80.0	NO – fairly free rooting to all directions

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BH 3

Tree Constraints Plan -BH01/02

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BH 4

Pre-Development Facilitation
Tree Works Schedule

Bernie Harverson arboricultural consultant

BJH.0388

TREE WORKS SPECIFICATION

Client : **158 Hart Plain Avenue Ltd.**

Site Location : **Brewmaster PH, 158 Hart Plain Avenue, Waterlooville**

Attention is drawn to the fact that some mature trees could provide suitable habitat for bird nesting (ivy and cavities) and bat roosting (ivy, branch cracks and cavities) and this might at certain times of year influence and possibly restrict the form of management which can be applied. Given the legal constraints imposed by the Habitat Regulations and the Wildlife and Countryside Act this may necessitate expert ecological advice being sought before proceeding with the recommendations.

No	Species	Tree Works Recommended
G1a	Pedunculate Oak *Quercus robur*	• Crown lift and re-shape crown (to the south side only) above the single storey building by shortening back laterals to provide a 1m to 1.5m clearance. • Remove 'droppers' from the undersides of the lowest limbs on the south side only. • Making final cuts wherever possible adjacent to living growth points • The intention is to give a more compact and upswept form to the crown providing adequate clearances to avoid damage from construction works without spoiling the overall shape of the tree in the process.
G1b	Pedunculate Oak *Quercus robur*	• Remove major dead wood only.
G1c	Sessile Oak *Quercus petraea*	• Remove major dead wood. • Excavate by hand to a depth of 300mm along the line of the edge of the new car park and under the supervision of an arboricultural expert cleanly sever the root material that is found (up to a maximum diameter of 25mm).
G2a	Pedunculate Oak *Quercus robur*	• Crown lift to provide a 2m to 2.5m ground clearance above the parking bays • Remove any major deadwood
G2b	Pedunculate Oak *Quercus robur*	• Crown lift to provide a 2m to 2.5m ground clearance above the parking bays • Shorten back and reshape the crown to the south side only by a maximum of 30% making final cuts wherever possible adjacent to living growth points and remove any deadwood • The intention is to give a more compact and upswept form to the crown providing adequate clearances to avoid damage from construction works without spoiling the overall shape of the tree in the process.

G3a	Pedunculate Oak *Quercus robur*	• Remove major dead wood only.
G3b	Pedunculate Oak *Quercus robur*	• Remove major dead wood only.
G3c	Pedunculate Oak *Quercus robur*	• Remove major dead wood only.

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BH 5

Tree Protection Plans
BH03a & 03b

1. Standard scaffold poles
2. Uprights to be driven into the ground
3. Panels secured to uprights with wire ties and where necessary standard scaffold clamps
4. Weldmesh wired to the uprights and horizontals
5. Standard clamps
6. Wire twisted and secured on inside face of fencing to avoid easy dismantling
7. Ground level
8. Approximately 0.6m driven into the ground

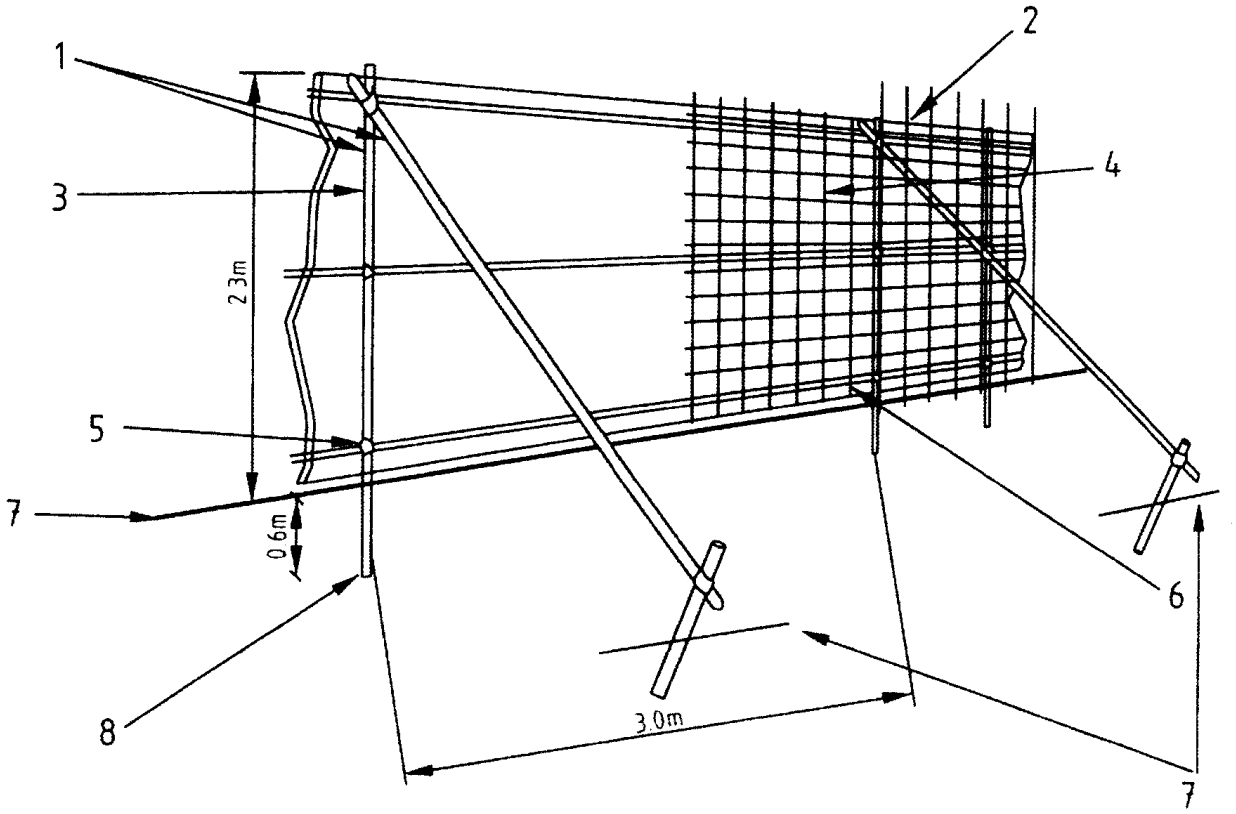


Figure 2 - Protective Barrier

Extract taken from BS5837:2005

9.2 Barriers

9.2.1 Barriers should be fit for the purpose of excluding construction activity and appropriate to the degree and proximity of work taking place around the retained tree(s). On all sites, special attention should be paid to ensuring that barriers remain rigid and complete.

9.2.2 In most cases, barriers should consist of a scaffold framework in accordance with Figure 2. comprising a vertical and horizontal framework, well braced to resist impacts, with vertical tubes spaced at a maximum interval of 3m. Onto this, Weldmesh panels should be securely fixed with wire or scaffold clamps. Weldmesh panels on rubber or concrete feet are not resistant to impact and should not be used.

NOTE The above is preferred because it is readily available, resistant to impact, can be re-used and enables inspection of the protected area.

9.2.3 It may be appropriate on some sites to use temporary site office buildings as components of the tree protection barriers.

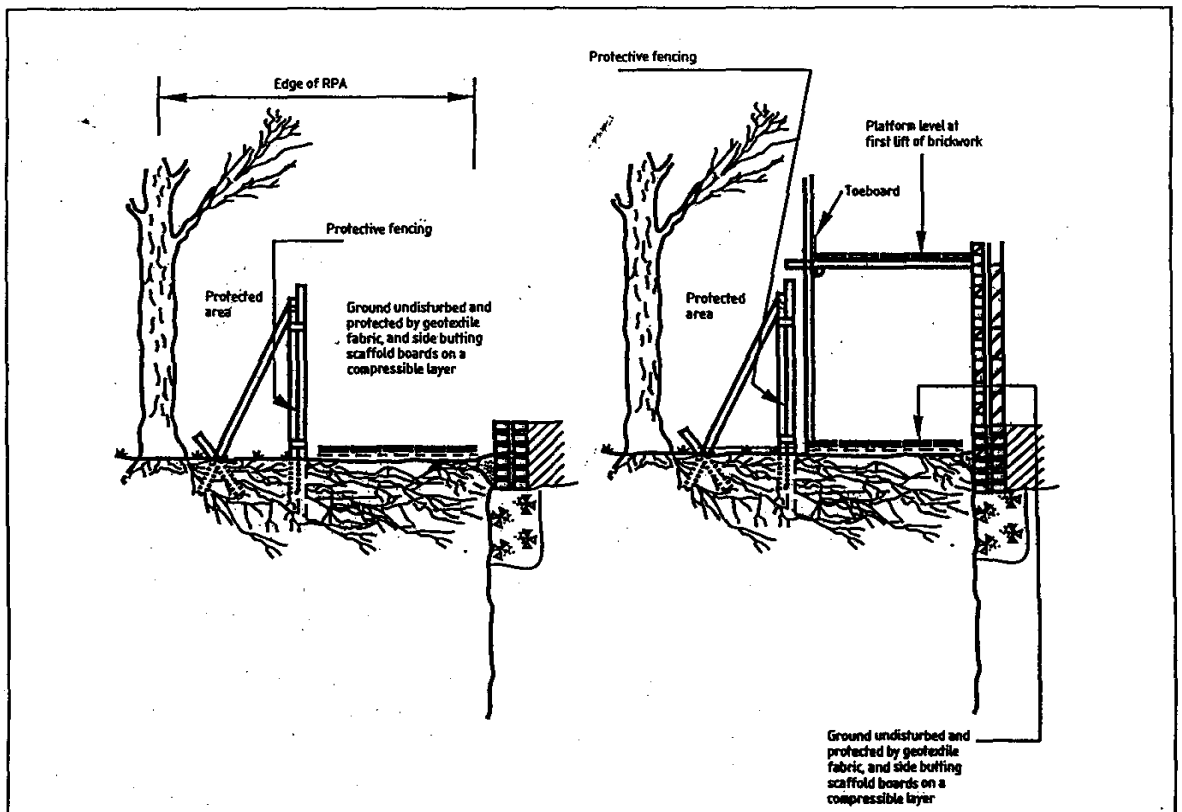


Figure 3 — Scaffolding within the RPA

Extract taken from BS5837:2005

9.3 Ground Protection

9.3.1 Where it has been agreed during the design stage, and shown on the tree protection plan, that vehicular or pedestrian access for the construction operation may take place within the root protection area (RPA), the possible effects of construction activity should be addressed by a combination of barriers and ground protection. The position of the barrier may be shown within the RPA at the edge of the agreed working zone, but the soil structure beyond the barrier to the edge of the RPA should be protected with ground protection.

9.3.2 For pedestrian movements within the RPA the installation of ground protection in the form of a single thickness of scaffold boards on top of a compressible layer laid onto a geotextile, or supported by scaffold, may be acceptable (see Figure 3).

9.3.3 For wheeled or tracked construction traffic movements within the RPA the ground protection should be designed by an engineer to accommodate the likely loading and may involve the use of proprietary systems or reinforced concrete slabs (see **11.8 and 11.9**).

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TREE PROTECTION AREA

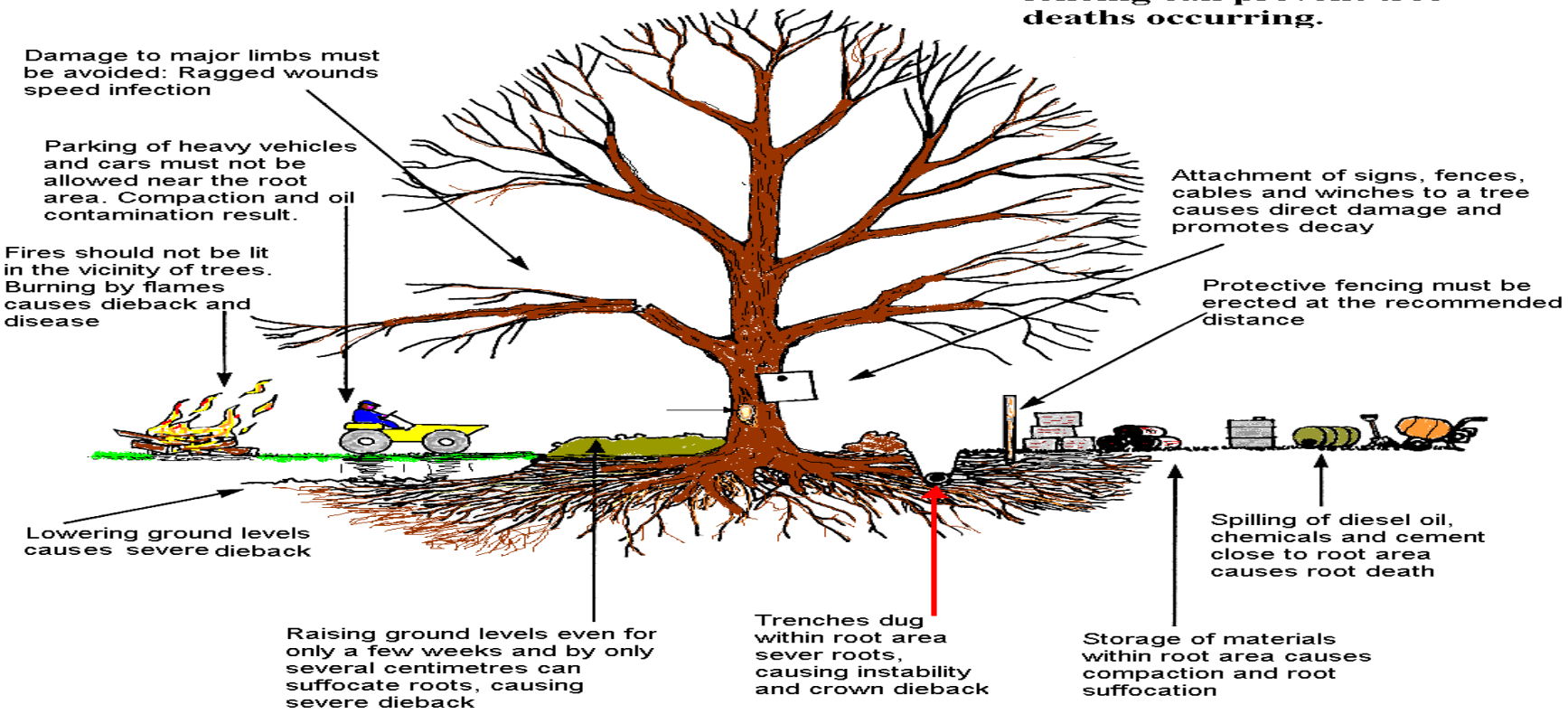
KEEP OUT

- NO EXCAVATION OR TRENCHING WORKS PERMITTED
- NO STORAGE OF PLANT OR MATERIALS PERMITTED
- NO VEHICLE ACCESS PERMITTED
- NO FIRE LIGHTING PERMITTED
- NO CHEMICAL HANDLING
- VEHICLES WORKING CLOSE TO PROTECTIVE FENCING MUST AVOID CONTACT WITH OVERHANG FROM TREE CANOPY

Common causes of Tree Death

BJH.0388

The use of properly positioned protective fencing can prevent tree deaths occurring.



Please use copies of this as an on-site poster for personnel

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BH 6

BS 5837:2005 Extracts

Table 3 - Sections 13, 14 and 15
& NJUG 10 Extracts

Table 3 – Minimum distance (m) between young trees or new planting and structures to avoid direct damage to a structure from future growth.

Type of Structure	Diameter of stem at 1.5m above ground level at maturity		
	<30cm	(30-60) cm	>60cm
Buildings and heavily loaded structures	-	0.5	1.2
Lightly loaded structures such as garages and porches	-	0.7	1.5
Drains and underground services:			
<1m deep	0.5	1.5	3.0
>1m deep	-	1.0	2.0
Masonry boundary walls[a]	-	0.5	1.0
	-	(1.0)	(2.0)
In situ concrete paths and drives[a]	-	0.5	1.5
	(0.5)	(1.0)	(2.5)
Paths and drives with flexible surfaces or paving slabs[a]	-	0.5	1.0
	(0.7)	(1.5)	(3.0)

[a] **These distances assume that some movement and minor damage might occur. Guidance on distances which will generally avoid all damage is given in brackets.**

Extract taken from BS5837:2005

13 Design considerations for new planting

13.1 General

13.1.1 The purpose of proposed new planting should be understood from the start of the design process so that appropriate choices of structure, location and species can be made. Advice on detailed design should be sought from a landscape architect or other competent person experienced in landscape design.

13.1.2 Trees may perform a variety of roles, both aesthetic and functional:

- shelter planting to benefit buildings, people, crops or stock;
- screen planting to hide the unsightly or create privacy;
- planting to define or divide spaces, or to define or direct routes or views;
- specimens or groups can be used for architectural effect to complement buildings;
- for their inherent aesthetic qualities;
- providing character or sense of place;
- softer, natural elements to counter the artificial lines of the built environment;
- for their contribution to nature conservation, biodiversity and biomass;
- reducing air pollution; providing shade and controlling erosion.

13.1.3 All new tree planting proposals should take into consideration the future use, layout and design of a development site, constraints of soil and climate, the local landscape character and the contextual surroundings. As trees generally form the dominant elements of the long-term landscape structure of a site, careful consideration should be given to their ultimate height and spread, form, habit and colour, density of foliage and maintenance implications.

13.2 Planting adjacent to buildings

13.2.1 On all soils, it is inadvisable to plant trees at distances closer to a structure than those shown in Table 3 unless special precautions have been taken. Paths, patios and driveways, where they are not constructed to appropriate standards (see **10.3 and [14]**) can be vulnerable to damage by trees with surface rooting characteristics. In addition, on shrinkable soils account should be taken of the foundation construction of existing and proposed nearby structures; planting should not compromise the structural performance of the foundation.

13.2.2 The effect of shade created by new trees and the likely extent and density of the tree crown when fully grown should be taken into consideration before new planting adjacent to buildings. Careful design and species selection should allow residents to enjoy reasonable light and the trees to develop into mature specimens. Special care should be exercised when considering planting large and/or fast growing evergreen trees as screens or hedging as these can be particularly oppressive, obstructing light all year round and requiring frequent maintenance to restrict their growth.

NOTE For information on planting adjacent to boundaries see Annex A and [6], [12] and [13].

13.3 Planting adjacent to roads

Roadside trees can make a significant contribution to the character of new developments. Their siting and species selection should be carefully co-ordinated at an early stage with other highway design considerations and, in the case of adopted roads, with the agreement of the relevant highway authority.

Sight line requirements, lighting schemes, CCTV, underground and overhead service routes and avoidance of physical obstruction or damage should all be taken into account with due consideration for future growth and periodic maintenance requirements.

13.4 Planting in the vicinity of services

Trees should not be planted where they might obstruct overhead power lines or cables. In new developments, underground services should be ducted or otherwise protected at the time of construction to enable trees to be planted nearby without conflict (see utilities guidance documents [17]). Root barriers should be constructed, where considered necessary, under expert advice to reduce the risk of tree root intrusion into service runs.

14 Ground works and preparation for new planting

NOTE BS 4428 contains recommendations and guidance on general landscape operations with sections on preliminary investigation, drainage, grading and cultivation, tree planting and woodland planting.

14.1 Drainage

New development may have an effect on the existing drainage pattern and ground water levels of a site, due to increased areas of hard surface and consequential drainage requirements. Existing trees may suffer due to an alteration in the supply of groundwater, whilst younger specimens and new plantings may be more likely to adapt to the changed conditions. Expert advice on both drainage and trees should be taken where ground water conditions are liable to such change.

14.2 Soil conditions

Before any of the landscape operations listed in BS4428 are undertaken and where contamination is apparent, soils in areas to be planted should be analysed for structure and content by a specialist laboratory and expert advice taken on remediation measures for new planting if this is required. If contaminants (e.g. oil or diesel fuel, toxic materials, heavy metals, etc.) are present, soils should either be removed to the full depth for planting and new soil imported or expert advice obtained on remediation measures, which may include limiting the choice of species for planting. Where the structure of the soil is in an unsuitable condition to encourage growth, a number of remediation measures may be required including physical decompaction by mechanical plant or compressed air injection, the incorporation of bulky additive materials and new drainage systems. The advice of an arboriculturist should be sought for all works in the root protection area.

14.3 Surfaces around newly planted trees

NOTE BS4428 provides recommendations for the treatment of soft surfaces, but excludes hard surfaces.

14.3.1 Where surfaces are paved, the settlement of the soil in tree pits which occurs gradually after planting may cause movement of the paved areas. This may involve the partial collapse or instability of paving or disruption of flexible surfaces, where these are laid over prepared pits. The unpaved area around new plantings should, therefore, be of an adequate size to enable surrounding paving to be retained by a conventional edging and foundation (e.g. brick, concrete, stone or treated timber) set at a distance where it is unlikely to be affected by settlement. It may be appropriate for the outer edges of the backfilled area to be treated as a transition zone using interlocking surface reinforcement grids backfilled with a surface dressing of a permeable, granular material (e.g. gravels, shingles and other aggregates) which can be topped up if required. Due allowance should be made for future growth of stem and roots of a tree when considering the finished dimensions and the design of edge or kerb treatments of tree pits and planted areas.

Where load-bearing paving is to be laid over pits, it should either:

a) be laid when the soil has settled and the level made good; or:

b) be laid on a supported foundation that spans the tree pit; or:

NOTE Such foundation may be constructed from reinforced concrete, or comprise bearers made from steel or concrete.

c) incorporate a tree grille with appropriate support around the edges.

d) utilise structural soil.

14.3.2 Where there is any risk of a tree pit receiving surface water run off that may be contaminated, for example by rock salt, fuel spillage or other materials that may be toxic or harmful to plants, paving should be designed and laid to fall away from the pit.

Extract taken from BS5837:2005

15 Post development management

15.1 Existing trees

15.1.1 Trees growing on a site before development takes place may, if adversely affected, be in decline over a period of several years before they die. This varies greatly depending on the age, species and condition of the tree, the soil conditions, climate and the extent of damage incurred during development. A programme of inspections and necessary work for the treatment of symptoms as they develop should be drawn up in conjunction with an arboriculturist. This programme may include recommendations for frequency of inspection and/or beneficial tree work and should take the form of an arboricultural management plan.

15.1.2 Where the trees in question are protected by planning controls, the planning authority should be informed and any necessary agreements obtained prior to such work.

15.1.3 Prior to handover, following completion of development, the arboriculturist should look for signs of intolerance to change in conditions and the effect of the development and any accidental damage to identify the need for further tree works in addition to those originally specified at the beginning of the development process.

15.1.4 An arboriculturist, should consider appropriate cultural operations. These may include irrigation, or measures to enhance the soil structure and organic nitrogen levels in the soil.

15.1.5 Where the development design incorporates the need for active management intervention following the completion of construction works, a tree or landscape management plan should be prepared and a copy supplied to all parties who may have an interest in the future management of the site or parts of it.

15.2 New plantings

Maintenance of newly planted trees is of particular importance during the critical establishment period, of at least two years and may, where required by planning conditions, be five years or more following planting. A detailed maintenance schedule covering the establishment period should be prepared in conjunction with the landscape design proposals and appropriate arrangements made for its implementation.

-EXTRACTS TAKEN FROM-

NJUG 10

NATIONAL JOINT UTILITIES GROUP

GUIDELINES FOR THE PLANNING, INSTALLATION AND MAINTENANCE OF UTILITY SERVICES IN PROXIMITY TO TREES

GAS - ELECTRICITY - TELECOMMUNICATIONS - WATER

UNDERGROUND SERVICES

2. HOW ROOTS ARE DAMAGED

2.1 Contrary to popular belief, the root system of a tree is not a mirror image of the branches, nor is there usually a 'tap root'. The majority of the root system of any tree is in the surface 600mm of soil, extending radially in any direction for distances frequently in excess of the tree's height. Excavation or other works within this area are liable to damage roots.

The root system

2.2 The base of the trunk typically flares out in buttresses, with these extending into the main lateral structural roots. These rapidly subdivide into the mass of smaller roots which serve to anchor the tree into the soil, and to conduct water and nutrients. Even a short distance (3m) from a large mature tree, most roots will be less than 10mm in diameter, but these may extend to well beyond the branch spread of the tree. A mass of fine roots, less than 1mm diameter, develop off all parts of this root system. These fine roots absorb the water and nutrients which are essential for the growth of the tree.

2.3 The main structural roots (close to the trunk) develop as the tree grows in response to the need for the tree to have physical stability. Beyond these major roots, root growth is influenced by the availability in the soil of water, air and nutrients. The cultivation of soil provides ideal conditions for root growth. Services are often cooler than surrounding soil, encouraging moisture within the soil to condense on the surface, thereby encouraging roots to grow close to the service. For all these reasons, root growth is often most prolific within the backfilled trench and in the soil around the services. The variability of soil conditions and the presence of obstacles to root growth results in a very variable and unpredictable distribution of the roots within the general guidance in para 2.1.

Types of damage

2.4 Root systems can be damaged by:-

- The severance of a root, for example by trenching, which will destroy all parts of the root beyond that point. Even roots less than 10mm diameter may be serving the fine roots over a wide area. The larger the root severed, the greater the impact on the tree.
- Damage to the bark on the root. The bark protects the root from decay, and is also essential for further root growth. It is loosely attached and easily damaged. If damage to the bark extends around the whole circumference, the root beyond that point will be killed.
- Compaction of the soil. Compaction which is avoidable may occur from storage of material or passage of heavy equipment over the roots. This can restrict or even prevent gaseous diffusion through the soil, and thereby asphyxiate the roots. The roots must have oxygen for survival, growth and effective functioning.
- Alterations in soil level. Lowering the level will strip out the mass of roots near the surface. Raising levels will have the same effect as soil compaction.
- Incorrect application of herbicide.
- Spillage of oils or other harmful materials.

2.5 If roots are damaged:-

1. close to the trunk, the anchorage and stability of the tree can be adversely affected.
2. anywhere along their length, all of the fine roots which they serve will be destroyed.

Damage to the fine roots by severance of a main root, or by compaction or alteration in levels, will prevent these fine roots from absorbing the water and nutrients which are essential for the well-being and growth of the tree. The effects of damage from different causes, for instance by successive excavations for different services, or by excavation in one part and compaction in another part of the system, will be cumulative.

2.6 If the root system is damaged, new roots must develop to sustain the tree. These may develop from damaged root or by increased growth of other parts of the system. It may take years to replace all the lost roots. Vigorous young trees are the most likely to be capable of rapid root regeneration, but mature tress find it very difficult to recover from major root damage, if at all. While roots may regenerate, they will not necessarily provide their original anchorage.

2.7 Trees with damage may not show any immediate symptoms. If the root system is capable of rapid regeneration the tree may recover without any noticeable ill-effects, but usually the symptoms will take several years to develop. Such symptoms may range from only minor branch dieback to deterioration and ultimate death of the tree, dependant on the severity of damage and the ability of the roots to regenerate.

2.8 There is frequently a need for operational land (e.g. substations) to be kept clear of weed growth for safety and as a fire precaution. Herbicides provide an efficient method of killing both herbaceous and woody weeds. There are several types of herbicide with different modes of action and persistence. The most attractive chemicals are those that can be applied to the ground, usually as a granule, and which remain active in the soil for long periods. The wide-ranging root system of a tree may extend into the operational land from adjoining properties, and may absorb some types of herbicides which have been applied to the ground. Material absorbed in one part of the root system can kill the whole tree.

2.9 Other materials which can leach into the soil can also damage the root system. For instance, oil spilled into the soil is broken down by soil bacteria which deplete the soil of oxygen and so asphyxiate the roots. Other materials may have a direct toxic effect on roots.

4 HOW TO AVOID DAMAGE TO TREES

4.1 This section gives general guidance on methods of work to minimise damage top trees which should be adopted by utilities. The local authority (or for privately owned trees, the owner or his advisor), should be informed about planned work at an early stage prior to commencement.

4.2 Wherever trees are present, precautions should be taken to minimise damage to the root system. As the shape of the root system is unpredictable, there should be careful control and supervision of any excavation, particularly if this involves digging through the surface 600mm where the majority of roots develop.

4.3 The precautions advocated in this section are applicable to any excavations or other works occurring within a distance from the tree equal to 4 times the circumference of the trunk (circumference measured around the trunk at a height of 1.5m above ground level; distance measured from the centre of trunk to nearest part of any excavation or other work). This area around the trunk is referred to as "the precautionary area" hereafter.

4.4 Although, ideally, services should be diverted or re-aligned outside the precautionary area, it is recognised that this will not always be practicable. Where works are required for the laying or maintenance of any service within the precautionary area, there are various techniques to minimise the damage. The appropriate method of laying will depend on the circumstances, such as:

- scope of the works (one off repair, or part of an extensive operation)
- degree of urgency (for restoration of supplies)
- soil conditions
- amenity value of tree
- cost

Acceptable techniques in order of preference are:-

1. **Trenchless**
2. Broken trench – hand dug
3. Continuous trench – hand dug

Excavation of open trenches by machine is totally unacceptable within the precautionary area.

4.5 Trenchless

4.5.1 Wherever possible trenchless techniques should be used. The pit excavations for starting and receiving the machinery should be located outside the precautionary area.

4.5.2 IN order to avoid damage to roots by the **mole**, it is recommended that the depth of run should be below 600mm. Techniques involving external lubrication of the mole with materials other than water (e.g. oil, bentonite)
should be avoided, unless precautions are taken to ensure that there is no contamination of the soil within 600mm of the surface within the precautionary area.

4.6 Broken Trench

4.6.1 This technique combines hand dug trench sections with trenchless techniques. If excavation is unavoidable, it should be limited to practical access and installation around/below the roots. The trench is excavated by hand with precautions taken as for continuous trench below. Open sections of the trench should only belong enough to allow access for linking to the next section. The length of sections will be determined by local conditions, especially soil texture and cohesiveness, as well as the practical needs for access. In all cases the open sections should be kept as short as possible.

4.7 Continuous Trench

4.7.1 The object of the exercise is to use manual excavation so as to retain as many roots as possible, bearing in mind the need for working space, access to the service in question and room to install the new service. Hand digging needs to be undertaken with great care and for this reason is likely to require closer supervision than normal operations and an understanding by all operatives and staff as to exactly what is expected.

4.7.2 After careful removal of the hard surface material, digging should proceed with hand tools. All roots greater than 25mm diameter should be retained and worked around. Where clumps of smaller roots (including fibrous roots) are found these should also be retained. During the excavation great care should be taken to minimise damage to retained roots, including the bark around the roots. Roots with a diameter in excess of 25mm must not be severed without the advice of the owner of the tree or the local authority arboriculturist, who should respond within one working day. If severance is unavoidable, roots must be cut back using a sharp tool (as listed below), leaving the smallest wound.

Suggested tools required: fork, breaker bar, secateurs, handsaw (folding, silky or bow saw), post hole shoveller and hand fork and trowel.

4.8 Backfilling

4.8.1 Any reinstatement must comply with the requirements of street works in Great Britain must comply with the requirements of the code of practice approved under the New Roads and Street Works Act 1991 (Specification for the Reinstatement of Openings in Highways). Without prejudice to the requirements of this code as to the specification of materials to be used and the standards of workmanship to be observed, backfilling of any excavation should be carefully carried to avoid direct damage to the retained roots and excessive compaction of the soil around them.

4.8.2 The backfill should, where possible, include the placement of an inert granular material mixed with top soil or sharp sand (not builders sand) around the retained roots. This should allow the soil to be compacted for resurfacing without damage to the roots, and should secure a local aerated zone enabling the root to survive in the longer term.

4.8.3 Backfilling outside the highway limits should be carried out using the excavated soil. This should not be compacted but lightly “tamped” and usually left slightly proud of the surrounding surface to allow natural settlement. Other materials should not be incorporated into the backfill.

4.8.4 Fine roots are vulnerable to desiccation once they are exposed to the air. Larger roots have a bark layer which provides some protection against desiccation and temperature change. The greatest risk to these roots occurs when there are rapid fluctuations in air temperature around them, e.g. winter diurnal temperatures. It is important, therefore, to protect exposed roots where a trench is to be left open overnight when there is a risk of frost. In winter, before leaving the site at the end of the day, the exposed roots should be wrapped with dry sacking. This sacking must be removed before the trench is backfilled.

4.10 Special Considerations when planning service routes

4.10.1 The potential for future conflict with trees cab be reduced at the stage of initial planning approval by the appropriate alignment of services and the provisions for future tree and shrub planting. Appropriate and separate space should be provided for each. Local authorities should liaise with developers.

4.10.2 If planning requirements and site constraints dictate that trees (existing or to be planted) and services share the same area, consideration should be given to increasing the depth of services, if possible to a minimum of 600mm, and to laying the service in ducts which will resist root penetration but allow replacements to be laid without extensive excavation. As this may incur additional costs, allowance must be made for these costs and the responsibility for meeting them at the planning stage.

4.10.3 When laying new services or replacements, to avoid risk of future direct damage, allowance should be made for future root growth.

4.10.4 Services laid in clay or peat should be constructed to tolerate movements associated with swelling or shrinking of the subsoil cause by root activity. Special precautions for differential movement should be incorporated where services join rigid structures founded at a different depth to the service.

Bernie Harverson
arboricultural consultant

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Qualifications & Experience

Bernie Harverson
arboricultural consultant

QUALIFICATIONS AND EXPERIENCE

- My name is Bernie Harverson and I am a self employed independent arboricultural consultant in private practice. I take instructions primarily in the South of England but also on occasions work nationwide and abroad and have offices at : –
  3 Foxcombe Cottages, South Harting, West Sussex GU31 5PL and also at Cedar Court, 5 College Street, Petersfield GU31 4AE
- I hold the following arboricultural qualification - **Master of Arboriculture** (Royal Forestry Society – 1976)
- I have over **forty** years of practical and managerial experience in the arboricultural industry including periods in both the public and private sectors.
- My Local Government sector experience comprises one year as a tree surgeon with Brighton Parks and nine years spent in Arboricultural Officer posts with both Westminster City Council and Portsmouth City Council
- My past practical experience in the private sector includes two years at Tilhill Forest Nursery and over ten years for various companies as a Climbing Arborist/Tree Surgeon.
- Managerial work in the private sector includes two years as manager of Beechings tree surgery company and twelve years with CBA Trees as an Arboricultural Consultant.
- As an independent self employed Arboricultural Consultant I now provide a comprehensive range of services including :-
  tree surveys, appraisals, assessments and inspections with particular reference to planning and development and tree safety audits with a service offered as a climber to undertake full climbing inspections to better understand the condition of a given tree before prescribing a management strategy.
  - I also undertake litigation work appearing as an Expert Witness in Court Actions and at Planning Appeals, Hearings and Public Local Inquiries.

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