HAYDEN'S
Arboricultural Consultants

Arboricultural Method Statement & Tree Protection Plan – In Accordance with BS 5837:2012

Proj. No **8080**	**St Andrew's Park, St Luke's Road, Uxbridge, UB10 0RX**		
Client:		Anchor Hanover	
Date of Report:	01/04/2020	Revision:	Original

Arboricultural Method Statement & Tree Protection Plan In Accordance with BS 5837:2012

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1.0 Introduction

1.1 Terms of Reference

1.1.1 Hayden's Arboricultural Consultants Limited has been commissioned by Anchor Hanover to prepare a bespoke Arboricultural Method Statement for the proposed development at St Andrew's Park, St Luke's Road, Uxbridge, UB10 0RX.

1.1.2 This report provides supplementary information to that submitted in the Tree Survey, Arboricultural Impact Assessment, and Preliminary Method Statement & Tree Protection Plan dated 26/07/2019, ref: 7100.

1.1.3 In accordance with the requirements of London Borough of Hillingdon Council, information is required regarding the following:

(i) Fencing
(ii) Ground Protection Measures
(iii) Access facilitation pruning
(iv) Construction Methods
(v) Services
(vi) Phasing and Monitoring Schedule

2.0 Specific Details

2.1 Fencing

2.1.1 Prior to the commencement of development and immediately after the completion of the necessary tree surgery and felling work, protective fencing will be erected on site. This must be fit for purpose (including any ground protection if necessary) in full accordance with the requirements of BS 5837:2012 and positioned as shown on drawing no. 8080-D-AMS (Appendix G).

2.1.2 Details of fencing are supplied in attached Appendix F.

2.2 Ground Protection Measures

2.2.1 During the construction process, Root Protection Areas must not be exposed to compaction or contamination. Where they cannot be enclosed by fencing (for practical site access reasons) it will be necessary to provide temporary ground protection that is fit for purpose. Examples of light weight and heavy duty ground protection measures are supplied in Appendix F.

2.2.2 Due to the complexities of construction, it is not possible to predict at this stage which type of ground protection will be necessary. Therefore, this must be agreed on site by the Monitoring Arboricultural Consultant (item 2.6.2).

2.3 Access Facilitation Pruning

2.3.1 Access facilitation pruning is fully detailed in the Tree Survey, Arboricultural Impact Assessment, and Preliminary Method Statement & Tree Protection Plan dated 26/07/2019, ref: 7100. However, for ease of data management the specification is reproduced at Appendix C.

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2.3.2 In order to construct hard surfacing for vehicular access, tying in with the allowable site levels, precautionary linear root pruning will be required. To undertake linear root pruning the following guidelines as set out in BS5837;2012 shall be followed:

- The excavation shall be dug by hand or with an air spade as per the specified design of foundations. This may also include the use of a vehicle mounted soil vacuum.

- Roots occurring within the excavation, smaller than 25mm in diameter, may be pruned back to the side wall of the trench by making a clean cut with suitable sharp tools such as bypass secateurs or pruning saw.

- Roots occurring in clumps or that are over 25mm in diameter should only be severed following consultation with the monitoring consultant arborist.

- If the trench is to be left open for longer than a period of 2 hours, the live roots will be wrapped in damp hessian to prevent the drying out of roots. The hessian may need to be re soaked dependant on weather and time.

- Prior to construction, a suitable approved root barrier should be considered in conjunction with the project engineer. This is to prevent both the chemical contamination to roots and the future risk of root damage to the hard surface.

2.3.3 All linear root pruning work will be undertaken with the monitoring consultant arborist in attendance to oversee the work. This will be further detailed within Statement of Supervision (Arboriculture) Appendix E.

2.4 Construction Methods

2.4.1 As part of the approved landscaping scheme, a footpath is to be constructed within the RPA of tree T002. This will need to be no dig in construction, building up from the existing levels within the RPA. The construction shall use a cellular confinement system, an example of which is provided at Appendix F.

2.4.2 The installation of the no dig footpath will require careful phasing in order to ensure T002 remains protected throughout construction. This footpath will not be used for construction purposes and will solely be used for residential usage after project completion. The following is an example method for construction but the exact method will need to be provided by the cellular confinement system manufacturer, in conjunction with the monitoring arboricultural consultant and project engineer:

- All protective fencing and any required ground protection will be installed prior to any construction work beginning on site.

- Any machinery to be used for the installation of the no dig surface will not exceed the maximum load bearing capacity of the surface. This is to ensure that compaction does not occur to the ground below or the cell-web matting does not become damaged.

- Should operatives or machinery need to operate off of the newly formed no dig surface, a suitable load bearing surface will be required such as a type of suitable ground protection.

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- The cell-web base of the no dig surface will then be laid out over the existing ground with a geotextile membrane beneath, and the edging also installed.

- Specified clean angular stone should then be used to fill the cell-web matting to a depth so that it buries the cell-web. The stone used should not include any fines within the stone.

- On top of the clean angular stone, another geotextile membrane is to be laid out with a 20mm deep sand bedding put on top. This is to prepare the no dig surface for its final layer of permeable block paving to be confirmed by the overall client.

2.4.3 The installation of the no dig surface must be monitored regularly and supervised where necessary by a competent Arboriculturalist to ensure that the arboricultural aspects of the no dig design are complied with. As such, a method statement flowchart/checklist included on drawing no. 8080-D-AMS should be used as an auditable monitoring schedule to assess the progress of key events/activities.

2.5 Services

2.5.1 At the time of writing this report, all proposed services have been located outside of the RPA of the retained trees. Therefore, no specialist construction techniques will be required for service installation.

2.6 Phasing and Monitoring Schedule

2.6.1 The proposal involves the integration of a number of complex aspects that affect tree protection (e.g. – but not exclusively – access and movement of materials). For this reason, the project must be carefully phased to ensure the highest level of protection for trees at all times. Accordingly, Hayden's Arboricultural Consultants have produced a method statement flowchart/checklist phasing recommendation to cover the major operations on site as they affect retained trees. This is included on drawing no. 8080-D-AMS.

2.6.2 In accordance with item 6.3 of BS 5837:2012, the site and associated development must be monitored regularly by a competent Arboriculturalist to ensure that the arboricultural aspects of the planning permission are complied with. As such, the method statement flowchart/checklist included on drawing no. 8080-D-AMS should be used as an auditable monitoring schedule to assess the progress of key site events/activities.

2.6.3 In addition to the method statement flowchart/checklist, it is beneficial to identify the key arboricultural responsibilities associated with the progression of the development. Accordingly, a draft "Statement of Supervision (Arboriculture)" has been included at Appendix E. The purpose of this document is to identify a definite decision making and data recording structure in the monitoring process, together with providing a list of specific inspection trigger points. Prior to works commencing on site, this document should be re-issued with contact names and document reference numbers included.

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3.0 Appendices

Appendix **A** Species List

Appendix **B** Schedule of Trees

Appendix **C** Schedule of Works to Allow Development

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Appendix **E** Statement of Supervision (Arboriculture)

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1. BS 5837:2012 Figure 1 - Flow Chart – Design and Construction & Tree Care
2. European Protected Species and Woodland Operations Checklist (v.4)
3. BS 5837:2012 Figure 2 - Default specification for protective barrier
4. BS 5837:2012 Figure 3 - Examples of above-ground stabilising systems
5 Figure 4 Detail of protective barrier where construction encroaches within BS5837:2012 Root Protection Area
6. Method Statement for 'No Dig' Construction in line with Arboricultural Practice Note 12 '*Through the Trees to Development*'
7. MultiTrack Ground Guards Specification
8. Air Spade/Air Excavation Specification

Appendix **G** Drawing No 8080-D-AMS

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Appendix A - Species List

Species List:

English Oak	*Quercus robur*

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Appendix B

Schedule of Trees

SCHEDULE OF TREES (AIA)

St Andrew's Park, St Luke's Road, Uxbridge,

Surveyed By: Steve Holyland
Managed By: Steve Holyland

Date:

TreeNo	Species	DBH	Height		Visual	Crown Spread	Problems / Comments	BS Cat	Work Required (TS)	Priority (TS)	Work Required (AIA)	Priority (AIA)
		Min Dist	Crown Base	Lowest Branch	Age	Water Demand						
On site		RPA (m²)	Aspect	Aspect	SULE	Ground Cover						
T001	English Oak	1050	23		Moderate	N13.5, E9.5,S8.0,W13.0	Large mature Oak tree in open space. Base of tree is slightly obscured by bramble. A large open wound is present from near ground level to 3 metres. Possibly caused by loss of limb tearing out. Occlusion has partly occurred. Main stem has a heavy lean to the north west and the crown is also asymmetric in this direction also. A possible stem bleed is present on a leader on the southern side at 11 metres however light makes it difficult to see clearly. The crown of the tree is visibly suffering with some foliage being stunted and an unusual amount of minor and major deadwood is present. No signs to cause but is likely a pathogen which has entered via a wound.	C1	Remove any major and minor deadwood present. Monitor annually to assess progression of dieback.	3	Crown lift to 3 metres.	0
		12.6	0-2m		M	High						
Yes		498.8			10 - 20 Years	Grass						
T002	English Oak	1270	25.5		Moderate	N8.5,E9.5,S13.0, W11.5	A large mature specimen in open space. Some level changes in RPA. Main stem has an established lean to the south. Crown is tall and broad. Great form and condition for age. Some minor and major deadwood present in crown but is typical for age of tree. No targets below at present. Very high quality tree with great potential. Likely a future veteran tree	A1	Remove major and minor deadwood.	3	Crown lift to 3 metres. Install no dig footpath.	0
		15	0-2m		M	High						
Yes		706.9			40+ years	Grass						

Appendix C

Schedule of Works to Allow Development

SCHEDULE OF WORKS (AIA)

St Andrew's Park, St Luke's Road, Uxbridge,

Surveyed By: Steve Holyland
Surveyed:
Managed By: Steve Holyland

Tree No.	Species	Work required	Priority
T001	English Oak	Crown lift to 3 metres.	**0**
T002	English Oak	Crown lift to 3 metres. Install no dig footpath.	**0**

Appendix D

Explanatory Notes

Explanatory Notes

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Categories

Below is an explanation of the categories used in the attached Tree Survey.

No Identifies the tree on the drawing.

Species Common names are given to aid understanding for the wider audience.

BS 5837 Main Category Using this assessment (BS 5837:2012, Table 1), trees can be divided into one of the following simplified categories, and are differentiated by cross-hatching and by colour on the attached drawing:

Category A - Those of high quality with an estimated remaining life expectancy of at least 40 years;

Category B - Those of moderate quality with an estimated remaining life expectancy of at least 20 years;

Category C - Those of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm;

Category U - Those trees in such condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years.

BS 5837 Sub Category Table 1 of BS 5837:2012 also requires a sub category to be applied to the A, B, C, and U assessments. This allows for a further understanding of the determining classification as follows:

Sub Category 1 - Mainly arboricultural qualities;

Sub Category 2 - Mainly landscape qualities;

Sub Category 3 - Mainly cultural values, including conservation .

Please note that a specimen or landscape feature may fulfil the requirements of more than one Sub Category.

DBH (mm) Diameter of main stem in millimetres at 1.5 metres from ground level. Where the tree is a multi-stem, the diameter is calculated in accordance with item 4.6.1 of BS 5837:2012.

Age Recorded as one of seven categories:

Y Young. Recently planted or establishing tree that could be transplanted without specialist equipment, i.e. less than 150 mm DBH.

S/M Semi-mature. An established tree, but one which has not reached its prospective ultimate height.

E/M Early-mature. A tree that is reaching its ultimate potential height, whose growth rate is slowing down but if healthy, will still increase in stem diameter and crown spread.

M Mature. A mature specimen with limited potential for any significant increase in size, even if healthy.

O/M Over-mature. A senescent or moribund specimen with a limited safe useful life expectancy. Possibly also containing sufficient structural defects with attendant safety and/or duty of care implications.

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D Dead.

Height Recorded in metres, measured from the base of the tree.

Crown Base Recorded in metres, the distance from ground and aspect of the lowest branch material.

Lowest Branch Recorded in metres, the distance from ground and aspect of the emergence point of the lowest significant branch.

Life Expectancy Relates to the prospective life expectancy of the tree and is given as 4 categories:

1 = 40 years+;

2 = 20 years+;

3 = 10 years+;

4 = less than 10 years.

Crown Spread Indicates the radius of the crown from the base of the tree in each of the northern, eastern, southern and western aspects.

Minimum Distance This is a distance equal to 12 times the diameter of the tree measured at 1.5 metres above ground level for single stemmed trees and 12 times the average diameter of the tree measured at 1.5 metres above ground level tree for multi stemmed specimens. (BS 5837:2012, section 4.6).

RPA This is the Root Protection Area, measured in square metres and defined in BS5837:2012 as "a layout design tool indicating 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 shown on the drawing.. Ideally this is an area around the tree that must be kept clear of construction, level changes of construction operations. Some methods of construction can be carried out within the RPA of a retained tree but only if approved by the Local Planning Authority's tree officer.

Water Demand This gives the water demand of the species of tree when mature, as given in the NHBC Standards Chapter 4.2 "Building Near Trees".

Visual Amenity Concerns the planning and landscape contribution to the development site made by the tree, hedge or tree group, in terms of its amenity value and prominence on the skyline along with functional criteria such as the screening value, shelter provision and wildlife significance. The usual definitions are as follows:

Low	An inconsequential landscape feature.
Moderate	Of some note within the immediate vicinity, but not significant in the wider context.
High	Item of high visual importance.

Problems/ Comments May include general comments about growth characteristic, how it is affected by other trees and any previous surgery work; also, specific problems such as deadwood, pests, diseases, broken limbs, etc.

Work Required (TS) Identifies the necessary tree work to mitigate anticipated problems and deal with existing problems identified in the "Problems/comments" category.

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Work Required (AIA)	Identifies the tree work specifically necessary to allow a proposed development to proceed.
Priority	This gives a priority rating to each tree allowing the client to prioritise necessary tree works identified within the Tree Survey. **1** Urgent – works required immediately; **2** Works required within 6 months; **3** Works required within 1 year; **4** Re-inspect in 12 months, **0** Remedial works as part of implementation of planning consent.

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BS 5837:2012 Terms and Definitions

Access Facilitation Pruning	One-off tree pruning operation, the nature and effects of which are without significant adverse impact on tree physiology or amenity value, which is directly necessary to provide access for operations on site.
Arboricultural Method Statement	Methodology for the implementation of any aspect of development that is within the root protection area, or has the potential to result in loss of or damage to a tree to be retained.
Arboriculturist	Person who has, through relevant education, training and experience, gained expertise in the field of trees in relation to construction.
Competent Person	Person who has training and experience relevant to the matter being addressed and an understanding of the requirements of the particular task being approached. *NOTE - a competent person is expected to be able to advise on the best means by which the recommendations of this British Standard may be implemented.*
Construction	Site-based operations with the potential to affect existing trees.
Construction Exclusion Zone	Area based on the root protection area from which access is prohibited for the duration of a project.
Root Protection Area (RPA)	Layout design tool indicating 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.
Service	Any above or below ground structure or apparatus required for utility provision. **NOTE** - examples include drainage, gas supplies, ground source heat pumps, CCTV and satellite communications.
Stem	Principal above ground structural component(s) of a tree that supports its branches.
Structure	Manufactured object, such as a building, carriageway, path, wall, service run, and built or excavated earthwork.
Tree Protection Plan	Scale drawing, informed by descriptive text where necessary, based upon the finalized proposals, showing trees for retention and illustrating the tree and landscape protection measures.
Veteran Tree	Tree that, by recognized criteria, shows features of biological, cultural or aesthetic value that are characteristic of, but not exclusive to, individuals surviving beyond the typical age range for the species concerned. **NOTE** - these characteristics might typically include a large girth, signs of crown retrenchment and hollowing of the stem.

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Appendix E

Statement of Supervision

St Andrew's Park, St Luke's Road, Uxbridge, UB10 0RX

Statement of Supervision (Arboriculture)

Introduction

In accordance with Planning Permission 585/APP/2019/829 (dated 18/02/2020), Anchor Hanover are undertaking the development of the above site.

The purpose of this document is to ensure that all works that have an impact on retained trees are undertaken in accordance with the approved Method Statement and Tree Protection Plan. As such, the purpose of the Statement is to identify the following arboricultural issues:

- Approved documents;
- Key staff and contacts;
- Critical phases of pre-commencement, induction and construction.

Approved Documents

The following documents must be available to all those with responsibility for arboricultural matters during construction:

- BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations.
- Notice of Planning Decision 585/APP/2019/829 (dated 18/02/2020).
- Preliminary Arboricultural Method Statement & Tree Protection Plan for this project – produced by Hayden's Arboricultural Consultants dated 22/07/2019.
- Arboricultural Method Statement & Tree Protection Plan for this project – produced by Hayden's Arboricultural Consultants dated 31/03/2020.

Key Staff

The following have or are to be appointed responsible for arboricultural matters at the site:

- Developer: Anchor Hanover (or their representative).
- Arboricultural Consultant: Hayden's Arboricultural Consultants Ltd. Contact Mr Stephen Holyland (Arboricultural Consultant) – 01284 765391, info@treesurveys.co.uk, (or his representative).
- Site Manager/Agent – TBC, (or their representative).

Critical phases of pre-commencement, induction, construction & completion

REF	ACTIVITY	ONE OFF /REPEAT	ATTENDEES	ACTION
1	Pre-commencement meeting (to discuss working methods, timescales and tree protection schemes)	One off	Developer, Arboricultural Consultant, Site Manager/Agent, Ground Works Contractor, Council Arboricultural Officer	Arboricultural Consultant to record minutes – copies to be submitted to attendees
2&3	Inspection of completed tree surgery & installed tree protection	One off	Arboricultural Consultant, Site Manager/Agent	Arboricultural Consultant to record minutes – copies to be submitted to Developer and Council Arboricultural Officer
4,6&7	Supervision of linear root pruning and installation of no dig surfacing	As required per progress of construction	Arboricultural Consultant, Site Manager/Agent, Contractors (as required)	Arboricultural Consultant to record minutes – copies to be submitted to Developer and Council Arboricultural Officer
8,9&10	Inspection of completed landscaping and planting and final tree inspection after tree protection is removed	One off	Arboricultural Consultant, Site Manager/Agent	Arboricultural Consultant to record minutes – copies to be submitted to Developer and Council Arboricultural Officer
11	Final monitoring visit and completion meeting	One off	Developer, Arboricultural Consultant, Site Manager/Agent, Ground Works Contractor, Council Arboricultural Officer	Arboricultural Consultant to record minutes – copies to be submitted to Developer and Council Arboricultural Officer

Variations and Incidents

Any proposed variations to the proposed working method (relating to arboricultural matters) will be referred by the on-Site Manger/Agent to the Developer who will seek advice from the Arboricultural Consultant. The Arboricultural Consultant shall advise on minor amendments (e.g. realignment of fencing etc) and will subsequently report these to the Arboricultural Officer by e mail or minutes. Issues directly relating to tree surgery or tree retention will be forwarded by the Arboricultural Consultant (with recommendations) to the Arboricultural Officer for approval. Except in an emergency situation **and** when the Arboricultural Officer is unavailable, no such actions will occur without the written approval of the Arboricultural Officer.

Stephen Holyland
Arboricultural Consultant
Hayden's Arboricultural Consultants Ltd

1st April 2020.

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Reasons for a Qualified Monitoring Arboriculturalist

It is essential that the works are monitored by a qualified and experienced Arboriculturalist for the following reasons.

1. An Arboriculturalist has the skill and expertise to identify if the approved tree surgery specification has been complied with and the knowledge to provide appropriate remedial advice.

2. It is necessary for informed decisions to be made regarding the impact of tree surgery, particularly root pruning. The location of roots is assessed via a calculation, but in reality, roots may grow in a more unpredictable fashion dependent on topographic and historic features. Under CDM it is essential that expert individual knowledge is available and can advise on the inevitable unforeseen circumstances that arise.

3. An Arboriculturalist provides the point of liaison and information exchange with the Local Planning Authority's Tree Officer who is also normally a qualified Arboriculturalist. This allows fellow professionals to discuss the technical matters that inevitably arise and agree appropriate and balanced solutions. Having an Arboriculturalist engaged on the supervision of a project provides comfort to the Local Planning Authority that tree protection measures are complied with and hence it is much more likely that there will be less direct scrutiny from the Local Planning Authority (regarding tree matters) during the build of the project than would otherwise be the case.

4. Arboricultural input is essential to confirm that tree protection measures are adequate and fit for purpose. This can often save the client time (and therefore money) by identifying working methods and systems that are site efficient.

5. As living entities sensitive to their environment, the condition of trees changes, and over the course of a project it may be necessary to advise on additional tree surgery or felling as a result of, for example disease or storm damage.

6. An Arboriculturalist will provide detailed briefing notes and "toolbox talks" to site staff to ensure their compliance with conditions and prevent arboricultural breaches of conditions arising which can have severe consequences for project progression.

7. Close liaison between the Site Manager and the Arboriculturalist will ensure that the retained trees are protected but as minimal an inconvenience to construction as possible. This leads to the final outcome which is the completion of the project with retained healthy trees complementing the buildings in the manner that the designers and planners envisaged.

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Tree Protection Briefing Note

Introduction:

The trees that are to remain as part of the development are important and must not be harmed. They have been carefully selected as part of an extensive appraisal, design and planning process and therefore are legally protected by a combination of Tree Preservation Orders and Planning Conditions. This means that any damage caused to retained trees is a serious offence, as is the undertaking of any work to trees that has not been authorised in writing by the Local Planning Authority. Contravention of this legislation is liable to lead to heavy personal or corporate fines together with the imposition of stop notices, expensive mitigation measures and replacement planting instructions. Given this, it is vital that all development staff are familiar with the approved Tree Protection Plan (TPP).

Typical Forms of Construction Damage to Trees:

1. **Physical Injury to Trunk and Crown**. Construction equipment can injure the above-ground portion of a tree by breaking branches, tearing the bark, and wounding the trunk. These injuries are permanent and, if extensive, can be fatal.

2. **Root Cutting*.** Excavation, grading and trenching associated with construction and underground service installation can be very damaging to tree roots which are vital for both anchoring the tree in the ground and gathering moisture and nutrients. Unacceptable levels of damage to the roots will lead to a tree losing vitality, dropping branches, dying or becoming unsafe – either immediately or in the future.

3. **Soil Compaction.** An ideal soil for root growth and development contains about 50% pore space for water and air movement. Tracking by construction equipment and the storage of materials can compact soil and dramatically reduce pore space. Compaction inhibits root growth, limits water penetration, and decreases oxygen needed for root survival. If the compaction is too severe, in addition to preventing effective root growth, it will cause physical injury to both anchor and feed roots.

4. **Smothering Roots by Adding Soil*.** The majority of fine moisture and nutrient absorbing roots are within the top 30 cm of soil. Even a few centimetres of soil piled over the root system to change the grade can smother fine roots and eventually lead to the death of larger roots.

5. **Rooting Zone Contamination*.** Many materials used on development sites (e.g. salt, lime, concrete, cement, oil) are toxic to trees. If such contaminants are spilled or allowed to leach into the RPA, they can quickly kill the roots, thus causing the same effects as root cutting, soil compaction and smothering.

* As the location of tree roots cannot be seen, each retained tree close to a developable portion of the site has a designated Root Protection Area (RPA) as shown on the approved TPP. No excavation, grading, trenching, storage of materials nor any other activity may take place within the designated RPA unless it is in accordance with the approved Tree Protection Plan and completed under the supervision of Hayden's Arboricultural Consultants.

Preventing Damage to Trees During Construction:

The approved TPP provides specific instruction on the tree protection measures required across whole site in order to prevent damage. The primary methods of protection are as follows: -

1. **Installation of Protective Fencing**. The alignment and specification of this is shown to scale on the approved TPP. It must be erected prior to any demolition or development commencing on site and must not be moved or altered without prior written agreement of the Hayden's Arboricultural Consultants or the Local Planning Authority. No activities may take place within the fenced area, and no materials may be stored within the fenced area. The fencing may not be removed until ALL construction activities in the vicinity have been completed and only then with the written agreement of Hayden's Arboricultural Consultants or the Local Planning Authority.

2. **Ground Protection.** Where fencing is impractical the TPP provides instruction on other forms of effective ground protection. An example of this would be the provision of a temporary load bearing surface to prevent soil compaction and contamination. This must be of bespoke design for each situation so as to ensure it is fit for purpose. As with the fencing, this must be installed prior to any demolition or development commencing on site and must not be moved or altered without prior written agreement of the Hayden's Arboricultural Consultants or the Local Planning Authority. The temporary ground protection may not be removed until ALL construction activities in the vicinity have been completed and only then with the written agreement of Hayden's Arboricultural Consultants or the Local Planning Authority.

3. **Monitoring Visits from Hayden's Arboricultural Consultants.** Under the terms of the planning permission the development must be monitored by an Arboriculturalist on a suitably frequent basis. The purpose of this is twofold: -
    a. To ensure that the above tree protection measures are complied with and report findings to the developers AND the Local Planning Authority.
    b. To be available to provide help and advice regarding the inevitable requests for changes and supervision when working around retained tree.

4. **Operational Planning.** Whilst it is understood that trees are far from the only issue to be managed on site, they do represent a significant and potentially costly constraint if the protection measures required in the TPP are not strictly adhered to and as a result construction damage to trees occurs. Therefore, if problems in terms of work space conflicting with tree protection measures are identified, early liaison with Hayden's Arboricultural Consultants is essential so as to agree supervised works, alternate working methods or if necessary seek additional approval from the Local Planning Authority. Failure to identify these matters at an early stage may lead to significant delays as it can be a lengthy procedure in gaining a response from the Local Planning Authority.

Conclusion:

- Tree Protection Measures are there to protect the environment. They are also there to protect you. If they are complied with, trees will not be harmed. Therefore, DO NOT amend the protection unless you have written consent from Hayden's Arboricultural Consultants or the Local Planning Authority.

- If you are unsure on any tree related matter, seek advice before you act. Hayden's Arboricultural Consultants will discuss your concerns and help find practical and timely solutions (where possible).

- Hayden's Arboricultural Consultants, in conjunction with the Local Planning Authority, may change the frequency of Arboricultural Monitoring Inspections if it is deemed necessary to ensure the approved standards of tree protection are adhered to.

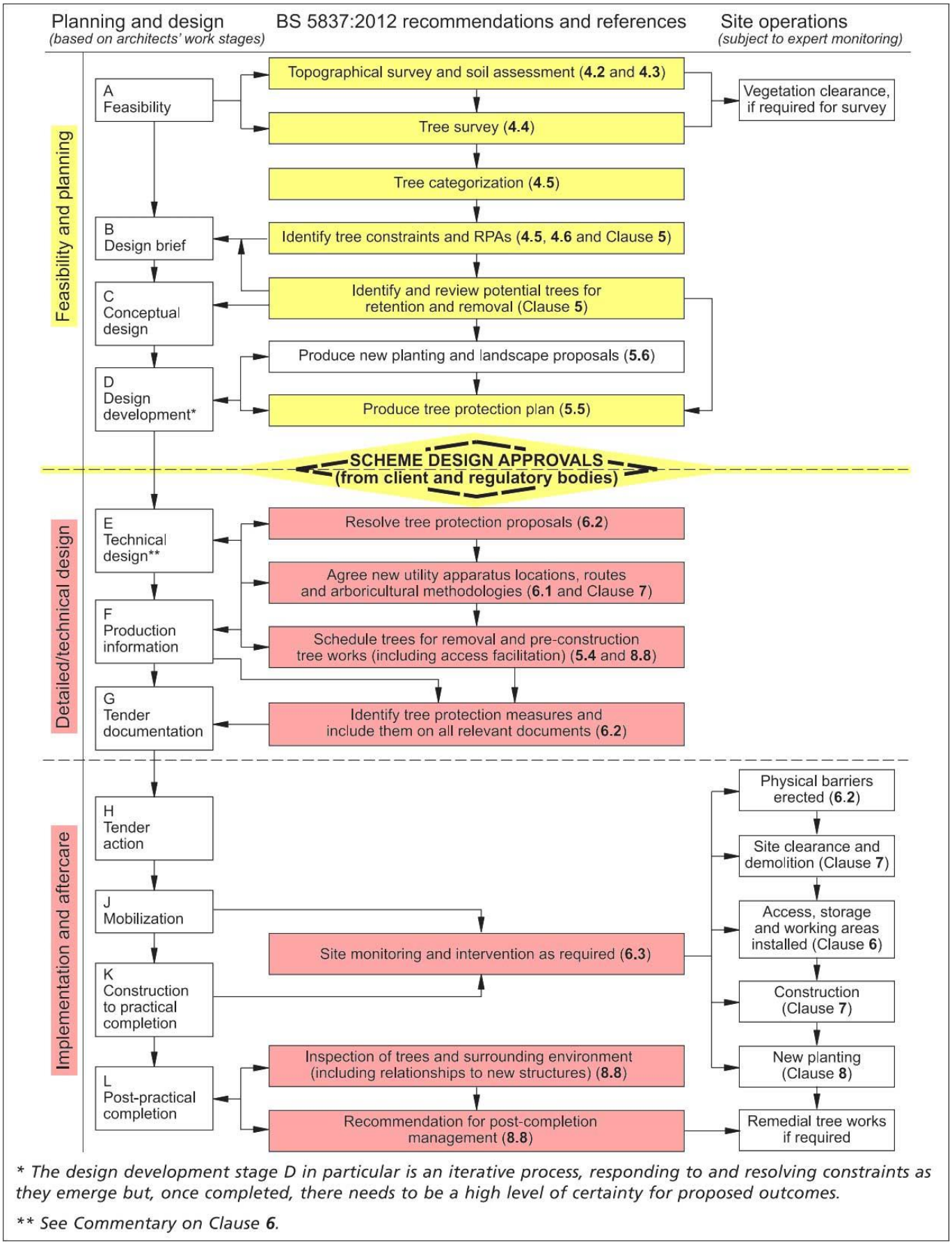
- Hayden's Arboricultural Consultants can be contacted in the first instance at the Head Office on 01284 765391.

David M Carmichael
Practice Manager

Appendix F

Advisory Information & Sample Specifications

1. BS 5837:2012 Figure 1 - Flow Chart – Design and Construction & Tree Care



** The design development stage D in particular is an iterative process, responding to and resolving constraints as they emerge but, once completed, there needs to be a high level of certainty for proposed outcomes.*

*** See Commentary on Clause **6**.*

2.

European Protected Species and woodland operations. (V4)

Complete all sections of the Checklist

✔

Checklist

1 **Are you within, or close to, the known mapped range of any of the protected species OTHER THAN BATS which are potentially everywhere? Tick any that apply.**
See distribution maps in the Good Practice Guidance for each species -

- ☐ Dormice
- ☐ Otters
- ☐ Great crested newts
- ☐ Sand lizards
- ☐ Smooth snakes

YES / NO

2 **Does your wood contain any of the following habitats? Tick any that apply.**

- ☐ Old trees with holes and crevices which might be used bats
- ☐ Species rich scrub/coppice, early growth stage plantations and forest interfaces
- ☐ Rivers on which otters might be found
- ☐ Ponds which might be occupied by great crested newts
- ☐ Open areas on heathy soils

YES / NO

3 **Have any of the protected species been recorded in this wood or on adjoining sites? Tick any that apply.**
Indicate which sources of information you have checked:

- ☐ National Biodiversity Network (www.nbn.org.uk)
- ☐ Local Biological Records Centre
- ☐ Local Wildlife Trust
- ☐ Other

Specify Other:

YES / NO

4 **Have your inspections or any expert surveys found any of the following signs or evidence? Tick any that apply.**

- ☐ Signs (e.g. otter spraint, nuts gnawed by dormice, leaves folded by newts)
- ☐ Sightings (or echo-location)
- ☐ Potential breeding or roosting sites (e.g. veteran trees, old trees with crevices, riverside hollow trees, ponds, timber stacks, large fallen deadwood)
- ☐ Confirmed breeding or roosting sites (i.e. evidence of sites actually being used)

Details:

YES / NO

Details

Name of Wood:

Grid Reference:

Area: (ha)

Date of Assessment:

Name of Assessor:

CHECK POINT

If you have answered NO to ALL of the above then only bats need to be considered in your operations.

If you have answered YES to any of the above then the species concerned must be considered as well as bats.

Notes

5 **Do the operations comply with Good Practice for bats and any other species found (or likely to be found in your wood) or can the operations be modified to do so?**
Details: Use reverse of form to expand as required:

YES — A licence is not required but continue to sections 6 and 7 below

NO — You will need to obtain a licence BEFORE carrying out the work (see EPS Licence Application Forms and Notes)

6 **Whether or not a licence is required...**
Has the information been communicated to operators (including the location of breeding sites and sensitive areas)? Tick any that apply.

- ☐ Included in documentation (e.g. contract, letter of instruction, site assessment or other management plan)
- ☐ Shown to operators and/or their supervisor
- ☐ Marked with paint or hazard tape
- ☐ Shown on the site plan

Other means:

YES

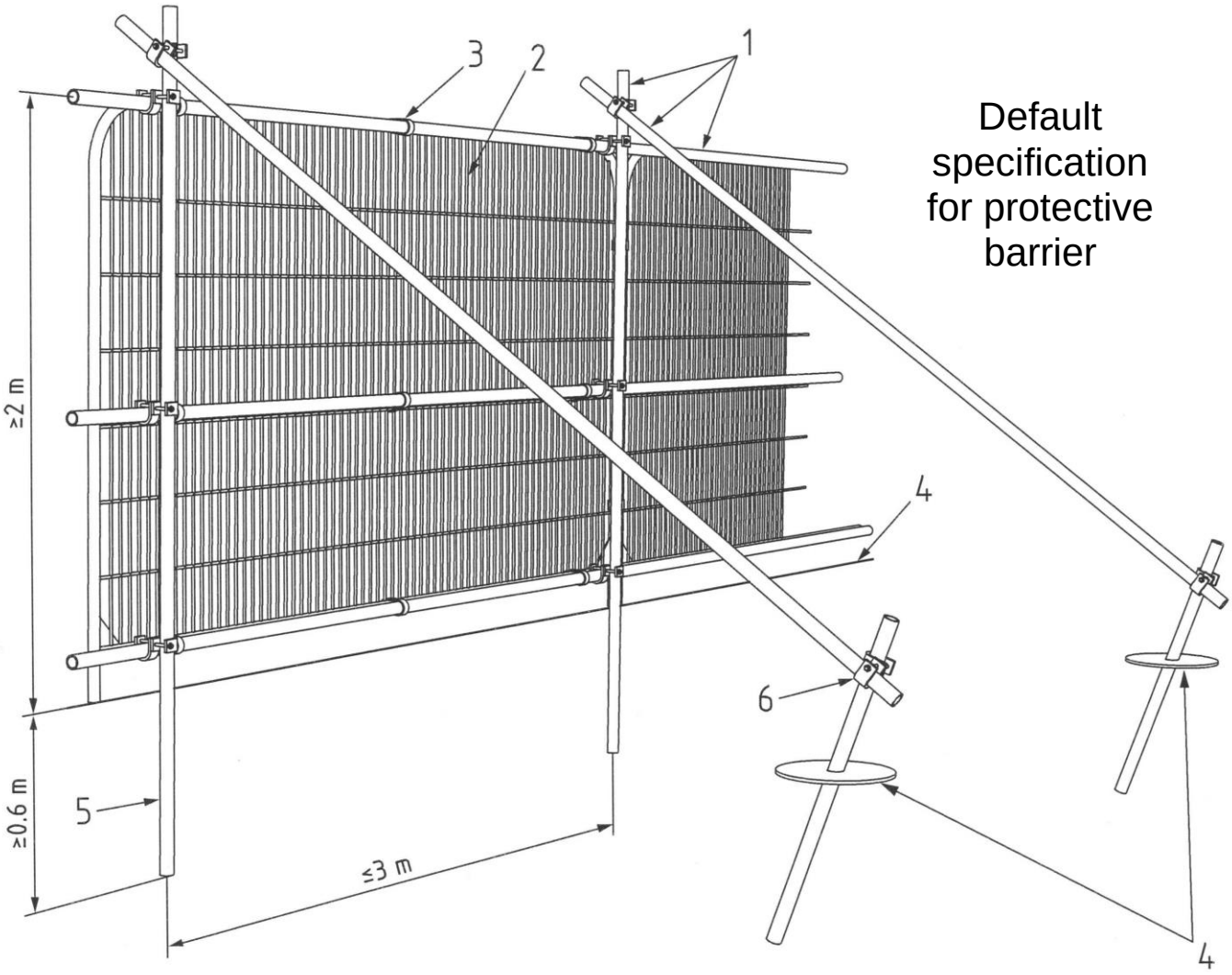
NO — You may commit an offence if you do not tell your operators about the protected species in your wood.

7 **Have arrangements for supervision been made to ensure Good Practice guidance is complied with during the operations?**
Details:

YES

NO — You may commit an offence if you do not take steps to ensure that your operators comply with the Good Practice guidance.

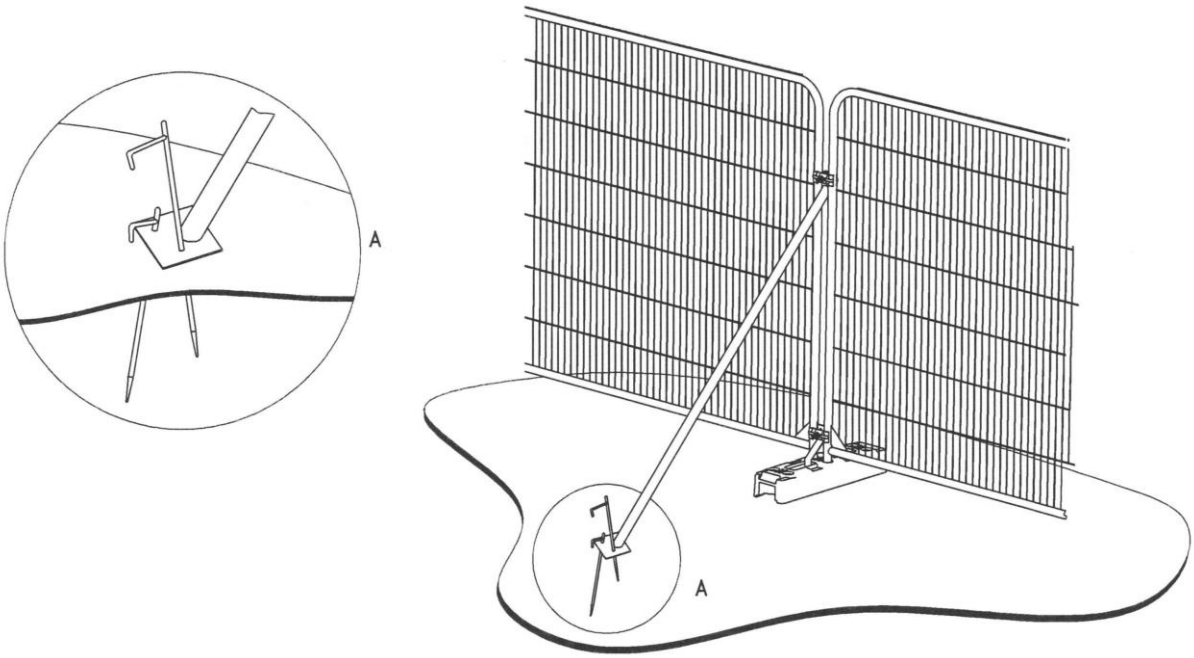
3. BS 5837:2012 Figure 2: Default specification for protective barrier



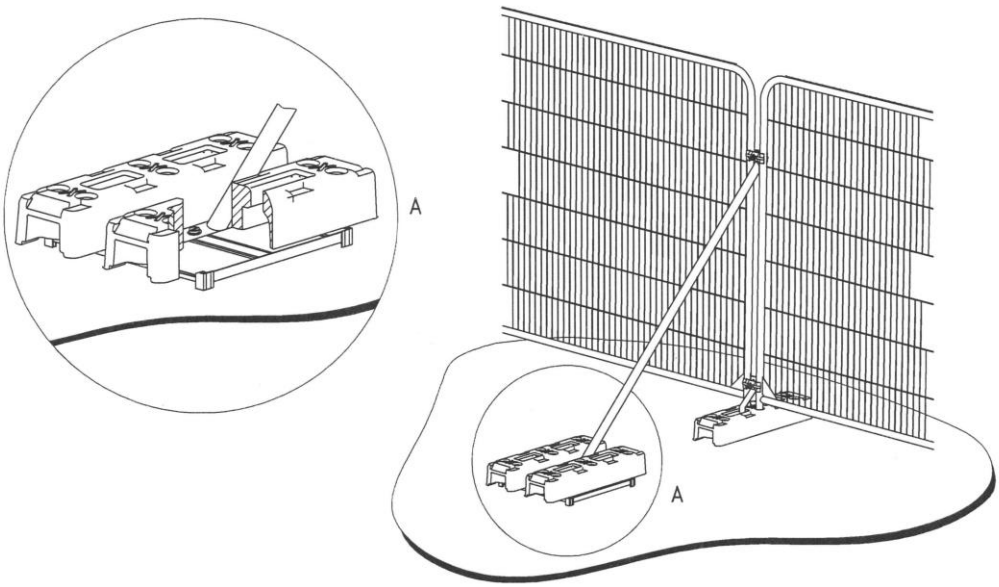
Key

1	Standard scaffold pole
2	Heavy gauge 2m tall galvanised tube and welded mesh infill panels
3	Panels secured to uprights and cross-members with wire ties
4	Ground level
5	Uprights driven into the ground until secure (minimum depth 0.6m
6	Standard scaffold clamps

4. BS 5837:2012 Figure 3: Examples of above-ground stabilizing systems

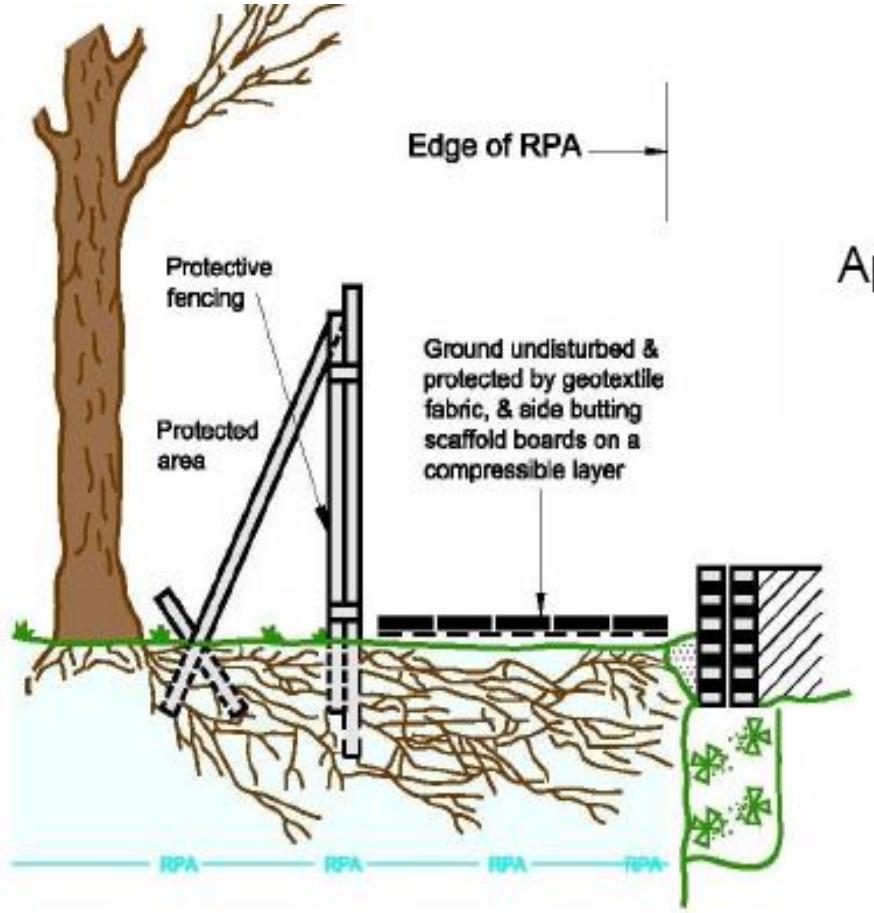


a) Stabilizer strut with base plate secured with ground pins



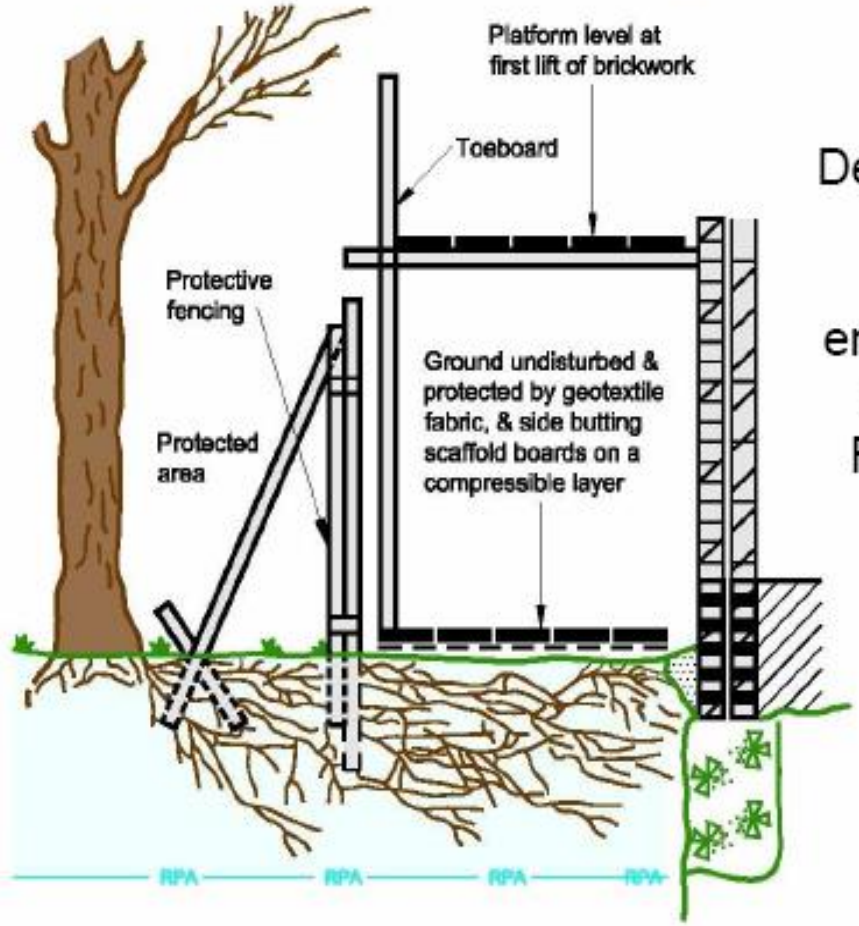
b) Stabilizer strut mounted on block tray

5. Figure 4 Detail of protective barrier where construction encroaches within BS5837:2012 Root Protection Area



Appendix No 2.1

Figure 4 –



Detail of protective barrier where construction encroaches within BS 5837:2012 Root Protection Area (RPA)

6. METHOD STATEMENT FOR "NO-DIG" CONSTRUCTION IN LINE WITH ARBORICULTURAL PRACTICE NOTE 12 "*Through the Trees to Development"*

Prior to commencing any demolition or construction on site, erect protective fencing around trees to form an exclusion zone (see attached plan).

This will ensure that roots will not be severed during the construction work and the soil in the area of the exclusion zone will not be compacted thus enabling oxygen to continue to diffuse into the soil beneath.

Construction of the driveway, path or other hard surface should be undertaken in dry weather between May and October when the ground is driest and least prone to compaction.

1 Kill ground vegetation using a translocated herbicide (glyphosate), ensuring that the selected herbicide doesn't damage the root of the tree(s) below the surface of the path.

2 Remove the dead or organic material from the site and ensure that large stones and shrub stumps are removed from the proposed route.

3 Any tree stumps should be ground out rather than excavated to minimize soil disturbance.

4 The resulting hollows and any other holes along the route driveway, path or other hard surface should be filled with sharp sand.

5 Lay *Terram Geotextile* matting across the full width of the driveway, path or other hard surface. This will prevent the intrusion of roots into the sub-base whilst still allowing nutrients and gaseous exchange.

6 Lay *Terram 150 Geocell* (cellular confinement system). (This is available from the Terram Ltd, tel: 01495 757722, fax: 01495 762393, and can be cut with a Stanley knife on site to the length, width and profile of the path required).

7 The driveway, path or other hard surface is to be supported against 150 x 20mm tanalised softwood boarding and 200mm long tanalised soft wood pegs driven into the ground at 1500mm centres.

8 Carefully push 20mm – 40mm gravel chippings (no fines) into the *Geo 150 Geocell* matting to form an aggregate sub-base.

9 The chippings should be placed at one end of the matting and pushed/spread across the matt to prevent compaction of the soil, working on either side of the driveway, path or other hard surface.

10 Compact the sub base to ensure binding with the *Geocell* and to minimise future wheel rutting.

11 Lay second layer of *Terram Geotextile* matting across the full width of the driveway, path or other hard surface. This will prevent the intrusion of fines into the gravel chippings.

12 Add layer of 'no fines, sharp sand and compact if using pavers as surface treatment.

13 Place proposed surface treatment (e.g. Pavers) on top of the compacted sub-base to form the finished surface to the path and 'bank up' the edging with topsoil, which is to be grass seeded in spring/autumn. This will form a gentle slope from the edging to the existing ground level.

1) Tanalised softwood pegs at 1500mm centres

2) Top soil banked up to edging

3) Softwood boards / Concrete edging 'tiles'

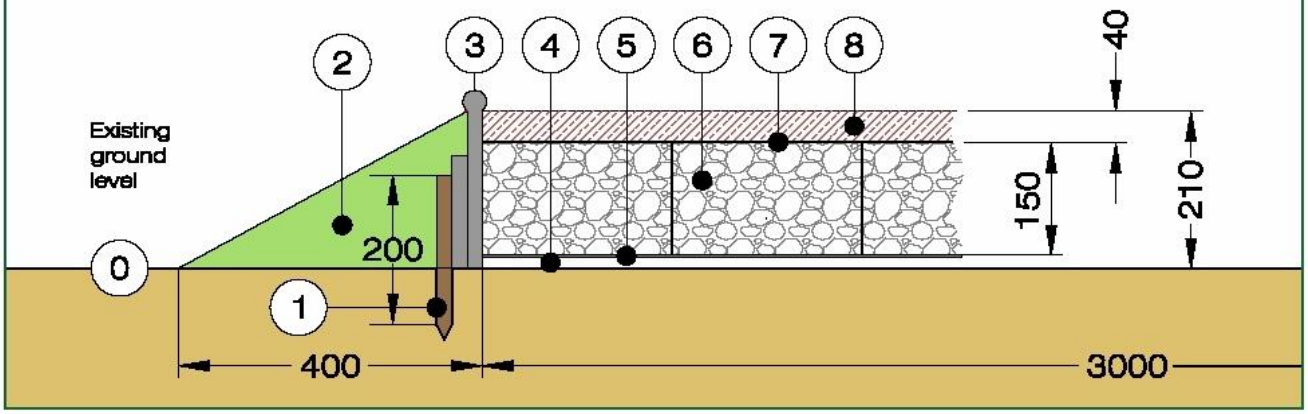
4) Existing surface to be cleared of ground vegetation using a translocated herbicide such as glyphosate

5) Geo-textile matting "Terram" laid on top of footpath

6) "Geocell" Cellular Confinement System (150mm deep) with gravel chippings

7) Geo-textile matting "Terram" laid on top of cellular confinement system

8) Gravel or paving laid on top of permeable sub-base



2) Top soil banked up to edging

3) Softwood boards / Concrete edging 'tiles'

4) Existing surface to be cleared of ground vegetation using a translocated herbicide such as "glyphosate"

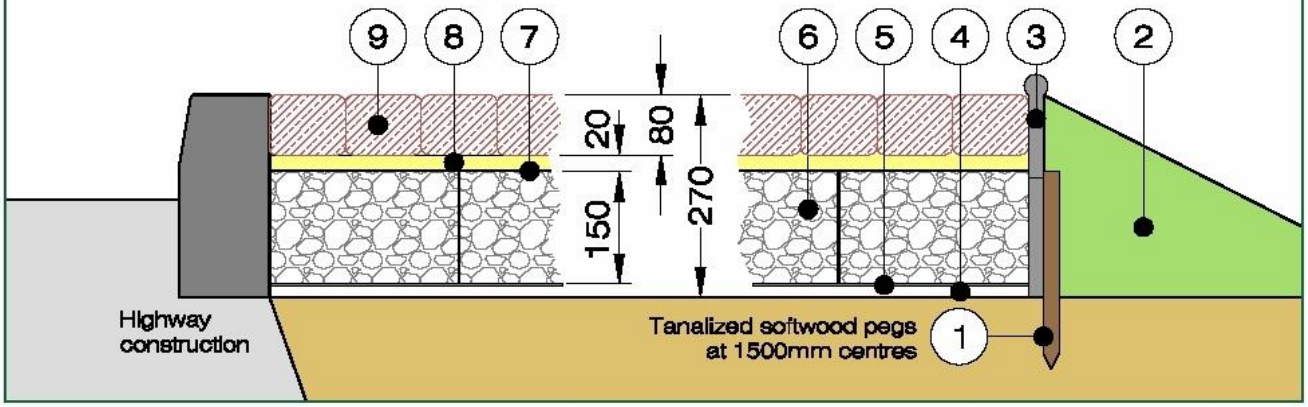
5) Geo-textile matting "Terram" laid on top of footpath

6) "Geocell" Cellular Confinement System (150mm deep) with gravel chippings

7) Geo-textile matting "Terram" laid on top of cellular confinement system

8) 'No fines' sand laid on top of geo-textile matting

9) Aquaflow permeable paving laid on top of no fines sharp sand and permeable sub-base



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www.treesurveys.co.uk

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'No Dig' Driveway & Parking Specification

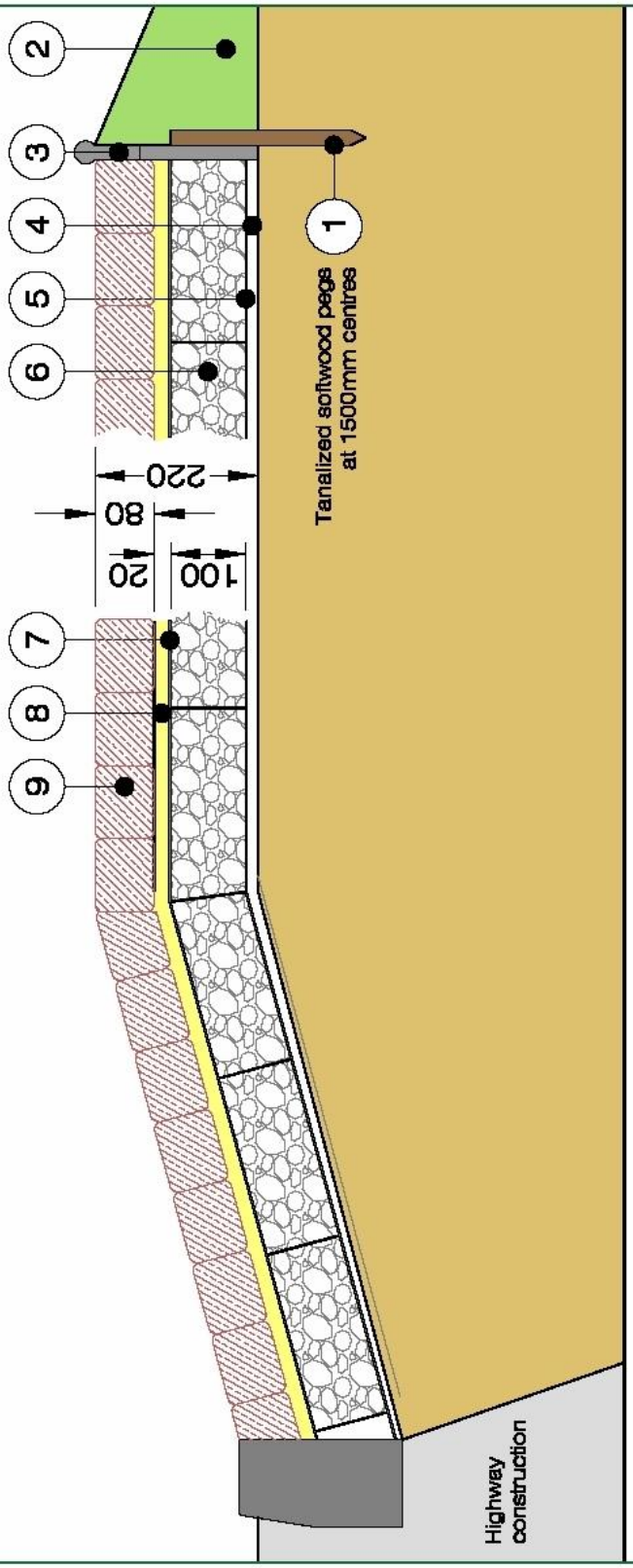
Scale

1:10 (A4)

Drg No.

Hayden's.ND

1) Tanalized softwood pegs at 1500mm centres
2) Top soil banked up to edging
3) Softwood boards / Concrete edging 'tiles'
4) Existing surface to be cleared of ground vegetation using a translocated herbicide such as glyphosate
5) Geo-textile matting "Terram" laid on top of footpath
6) "Geocell" Cellular Confinement System (150mm deep) with gravel chippings
7) Geo-textile matting "Terram" laid on top of cellular confinement system
8) ' No fines' sand laid on top of geo-textile matting
9) Gravel or paving laid on top of permeable sub-base



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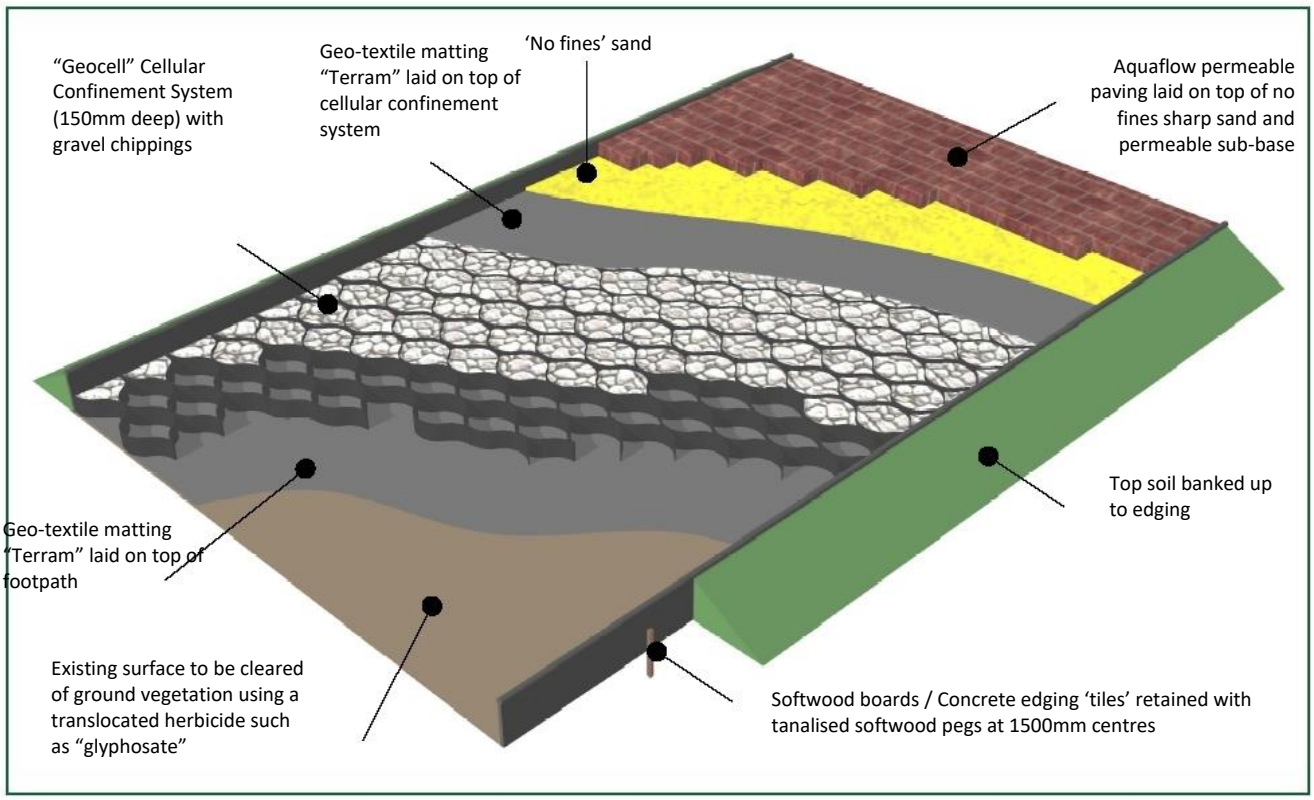
'No Dig' Footpath & Driveway Specification

Scale
1:10 (A4)

Drg No.
Hayden's.ND



The 3D drawing above may not accurately depict the construction to be carried out and should be taken as indicative only. Use the section drawings on the previous page for full details on the required construction method

'No Dig' system during construction (right)

"Geocell" Cellular Confinement System (100mm deep) with gravel chippings (below)

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The Aquaflow® range of permeable paving

Aquaslab®

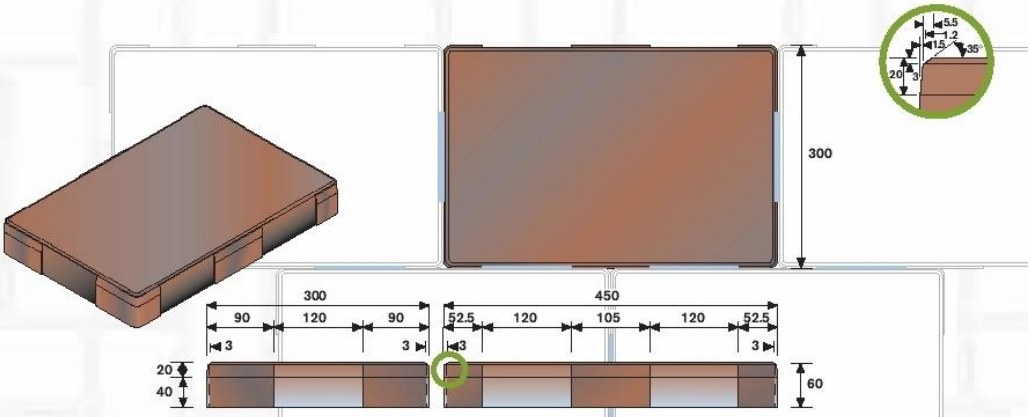
For use on Pedestrian areas

Size
300 x 450 x 60mm

Laying pattern
Staggered stretcher bond

Colours*
Natural, Burnt Red, Red brindle, Golden brindle and Charcoal

Finish
Standard
Bush hammered to special order



Aquasett®

For use on footpaths, domestic drives and roads (80mm)

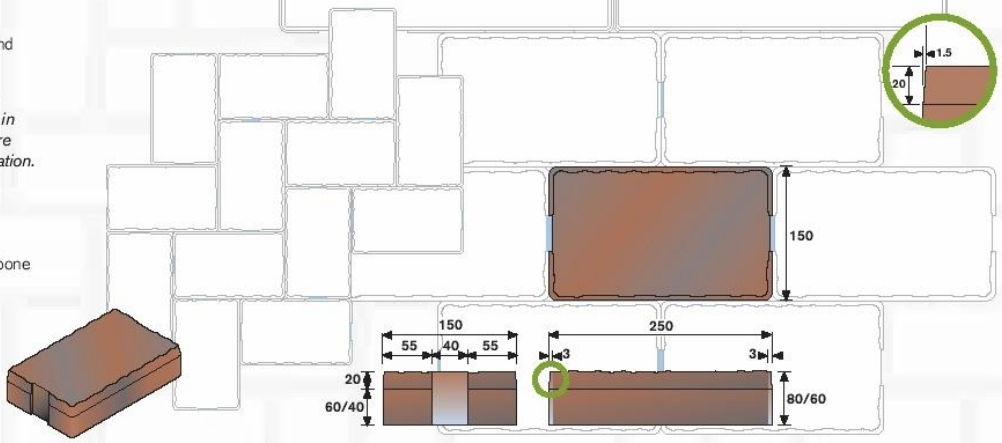
Range of colours and the Olden finish make the Aquasett appropriate for use in conservation areas or on projects where architectural heritage is a major consideration.

Sizes
150 x 250 x 60/80mm

Laying pattern
Staggered stretcher bond or 90° herringbone for trafficked areas.

Colours*
Traditional, Red Brindle, Vendage and Pennant.

Finish
Olden
Bush hammered to special order



Aquasett combined®

For use on footpaths and domestic drives

Range of colours and the Olden finish make the Aquasett combined appropriate for use in conservation areas or on projects where architectural heritage is a major consideration

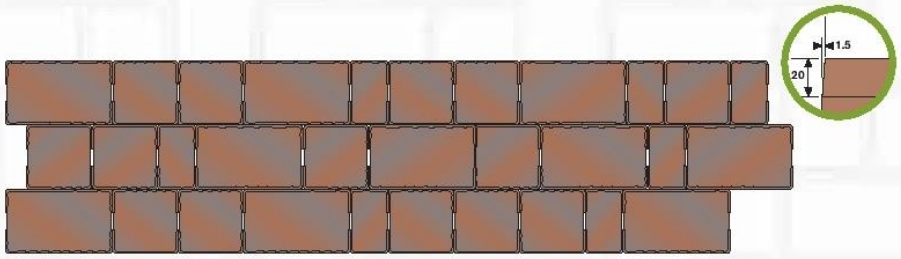
Sizes
Large 150 x 250 x 60/80mm
Medium 150 x 150 x 60/80mm
Small 100 x 150 x 60/80mm

Ratio of blocks in 0.8 square metre manufactured format: 10 large, 14 medium and 7 small.

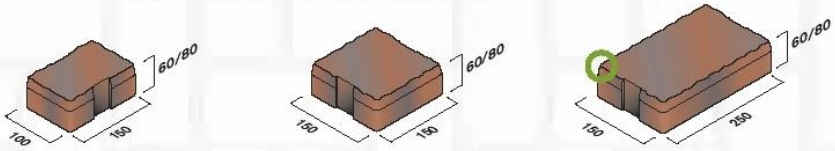
Laying pattern
Staggered stretcher bond

Colours*
Traditional, Red Brindle, Vendage and Pennant.

Finish
Olden
Bush hammered to special order



Aquasett combined (0.8 square metres-one pallet layer)



Formpave have designed a range of Aquaflow paving blocks to be used in conjunction with either tanked or infiltration systems.

The range consists of six blocks manufactured from concrete with a tensile splitting strength in accordance with BS EN 1338:2003.

Included within the range is the Aquaslab which has been designed for use on non-trafficked pedestrian areas.

All of the blocks and slabs provide drainage through vertical channels and will allow water through the surface at a rate of approximately 9000mm per hour (9000 litres per m^2 per hour). The Inbitex geotextile beneath the laying course will allow approximately 4500 litres per m^2 per hour through and this figure should be used for design purposes.

The Aquaflow ML block system consists of an interlocking block with specialist top, bottom and edge blocks and has been specifically designed for heavy duty applications.

The ML blocks can be laid by hand or by machine. Where the blocks are machine laid modules of .65m^2 are laid in one pass. Laying rates of over 600m^2 per day have been readily achieved with a three man crew.

* Other colours and finishes such as EcoGranite are available to special order.

Aquaflow block®

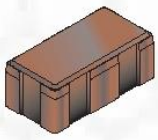
For use on car parks, drives and moderately trafficked areas

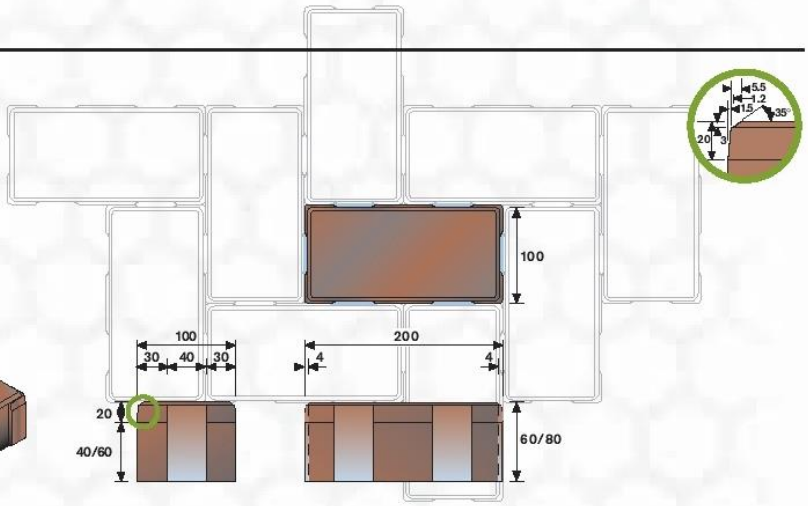
Sizes
100 x 200 x 60/80mm

Laying pattern
Must be laid in 90º herringbone

Colours*
Natural, Burnt Red, Red brindle, Golden brindle and Charcoal.

Finish
Standard
Bush hammered to special order





Aquaflow ML block®

For Roads and heavy duty use

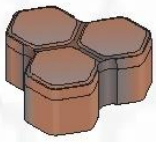
Size
80mm

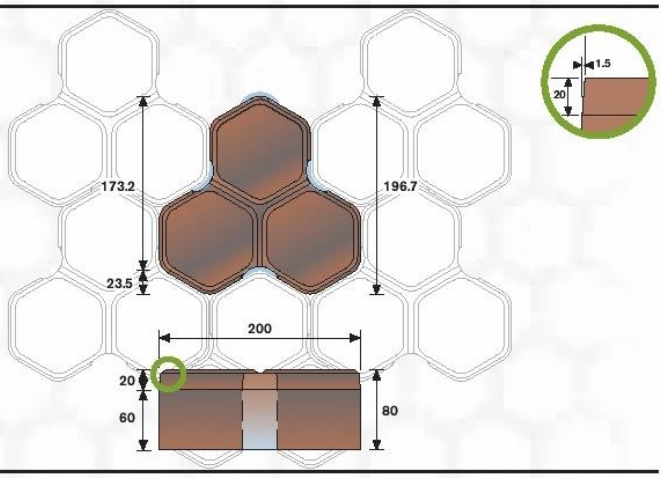
Laying pattern
Include stretcher course around edge in conjunction with MLE and MLTB

Colours*
Natural, Burnt Red, Red brindle, Golden brindle and Charcoal.

Finish
Standard

Not available in EcoGranite





Aquaflow MLE® *top drawing*

End block
For use with Aquaflow ML blocks

Aquaflow MLTB® *bottom drawing*

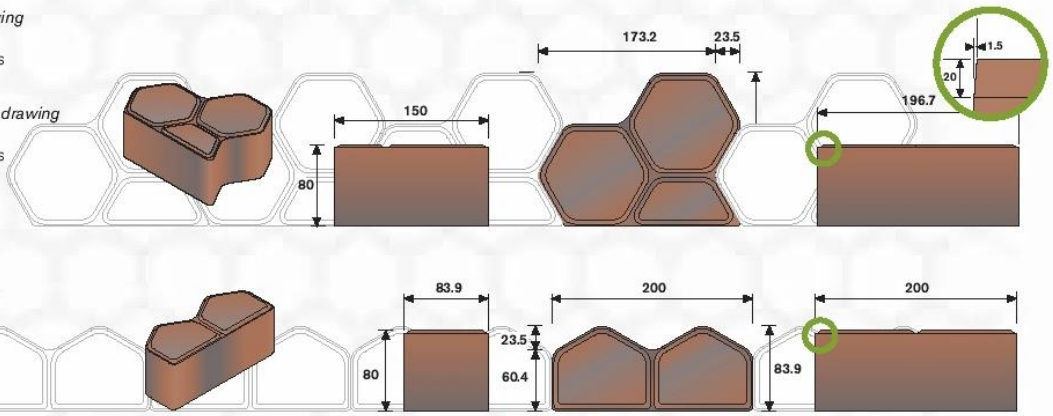
Top and bottom block
For use with Aquaflow ML blocks

Size
80mm

Colours*
Natural, Burnt Red, Red brindle, Golden brindle and Charcoal.

Finish
Standard

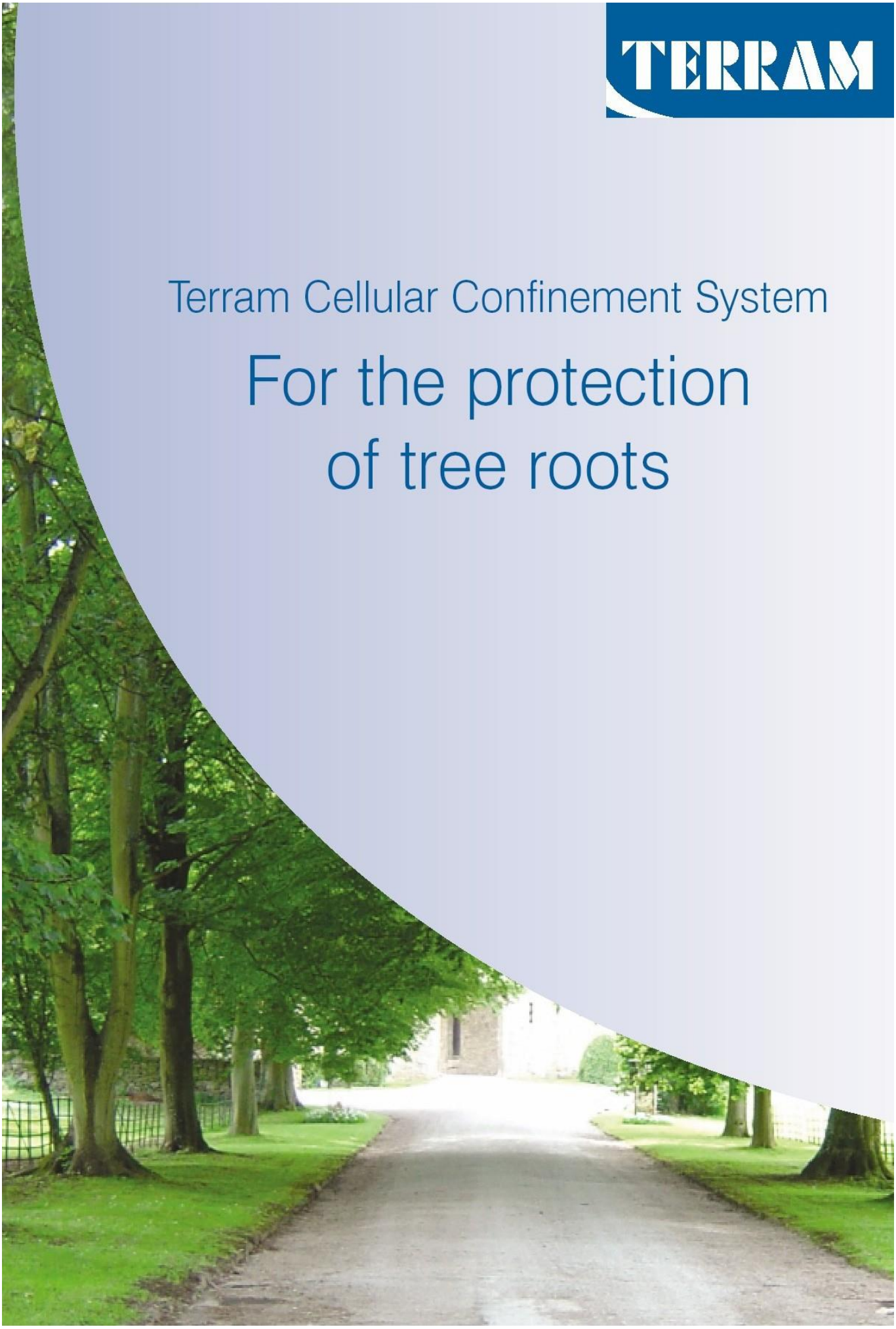
Not available in EcoGranite



TERRAM

Terram Cellular Confinement System

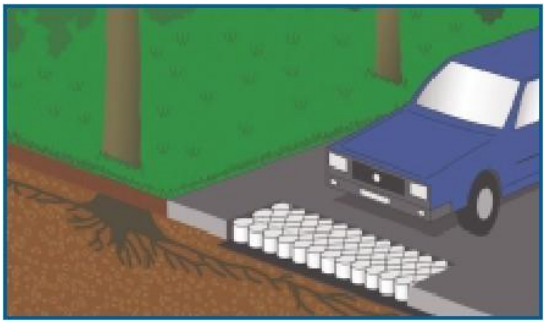
For the protection of tree roots



Cellular Confinement Systems

The perfect no-dig ground reinforcement system. Provides above-ground load bearing for paths and driveways whilst preventing soil compaction and protecting tree roots.

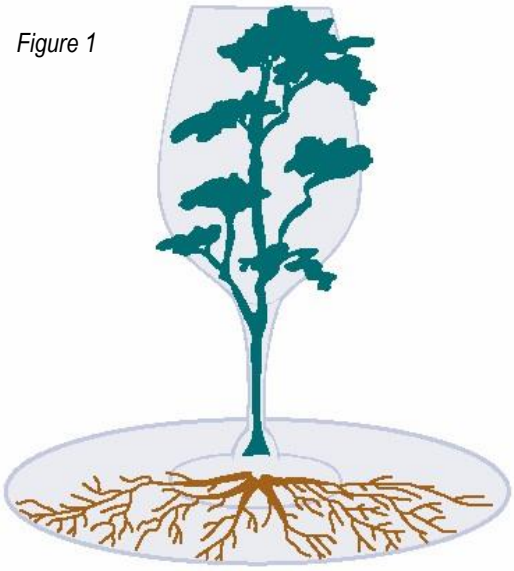
Damage to tree roots during driveway construction



The conventional method for constructing paths, drives and roads involves excavating soil to enable the installation of a sub-base that will adequately support traffic loads. Unfortunately this method of construction can badly damage trees since a by-product of the excavation is root severance. Most people don't realise that trees are very sensitive to disturbances in the soil around them. The reason for this is that, contrary to popular belief, trees do not have massive roots that go deep down into the soil but rather have lots of relatively small roots (frequently only a few centimetres in diameter) which spread out from the tree very close to the soil surface for quite large distances (often equal to the height of the tree).

If you imagine a tree system as a wine glass standing on a dinner plate you will have a roughly accurate idea of the above and below ground proportions of a tree (Figure 1). It may come as a surprise to learn that about 80-90% of all tree's roots are in the upper metre of soil (Figure 2). These roots serve two purposes: anchorage and absorption of moisture. If even relatively small roots are severed, for example by digging a trench, the tree can begin to suffer symptoms of drought stress as it is no longer able to obtain all its water needs. In addition the tree may become unstable as cutting the roots is a bit like cutting the guy roots on a tent.

Figure 1



It is not only root severance that may harm trees but also compaction of the soil. If the root zone of a tree is not protected during development then the soil may become compacted by vehicles or heavy machinery moving repeatedly over the ground (Figure 3). The effect of compaction is to close up pores in the soil which contain air and water. The tree's roots then suffer from both a lack of oxygen and a lack of moisture, and, as the soil becomes denser, roots find it hard to penetrate the soil. All this can lead to a dieback of the root system and frequently dieback of the tree. Raising of soil levels has a similar damaging effect as it deprives roots of oxygen and creates a build up of harmful carbon dioxide around the roots.

So, How Do Tree Roots Grow?

People often wrongly assume that tree roots are thick and grow down into the soil for many metres (Figure A). In reality tree roots:

- Are usually only large near to the trunk and get thinner the deeper and further from the tree they go. At a distance of just 3-4 metres from the trunk most roots are no bigger than a few centimetres in diameter.
- Spread outwards from the trunk, more or less parallel with the soil rather than growing downwards (Figure B).
- Can spread horizontally in any direction for a distance equivalent to at least the tree's height.
- Are usually relatively shallow; 80-90% of a tree's roots are in the Upper metre of soil. Few roots reach depths of more than about 2-3 metres and at this depth they are only a few millimetres in diameter.

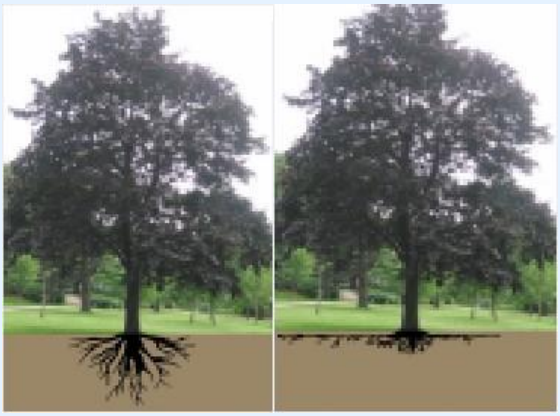


Figure A: Incorrect *Figure B: Correct*

British standard for trees in relation to construction and APN1

In recognition of the fact that trees are sensitive to disturbance the British Standards Institution has published recommendations on how to protect trees during development. In line with the earlier British Standard (BS 5837: 1991) the most recent guide, published in September 2005 (see further reading), recommends that there should be a 'root protection area' in which development should not be permitted.

In most case this are has a radius equal to twelve times the trunk diameter and forms a exclusive zone around the tree protected by means of robust fencing. This guidance had the effect of prohibiting the installation of roads, driveways and parking areas near to trees. But in 1996 the Arboricultural Advisory and Information Service published Arboricultural Practice Note 1 Driveways Close to Trees (APN1) which suggested that driveways could be installed within the root protection area provided roots and soil were not damaged.

The conditions set out for a suitable system were as follows:

- Roots must not be severed
- Soil should not be compacted
- Free movement of oxygen and carbon dioxide into and out of the soil should be maintained
- Water infiltration into the soil should not be impeded

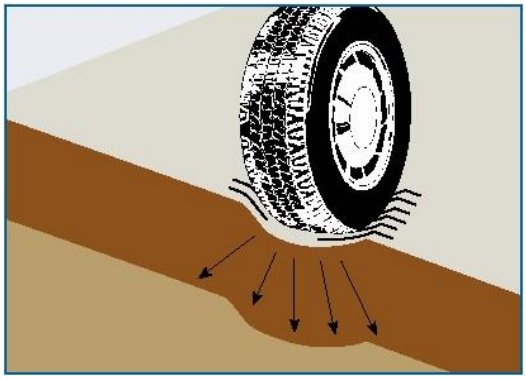
The, APN1 advised that driveways could be installed within the root protection zone provided that an above-ground, no-dig construction was used. This advice was incorporated into the recent British Standard which recommended that the most effective means of achieving this was through the use of a three-dimensional cellular confinement system.

Terram Geocell ground protection

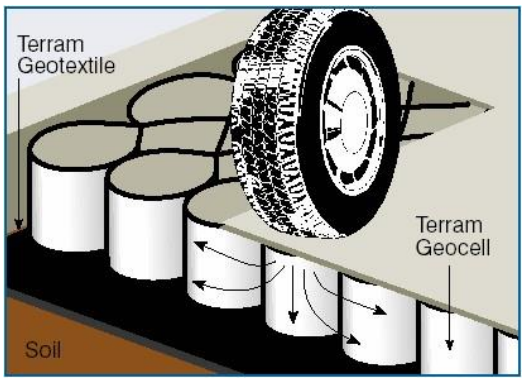
Terram Geocell is an ideal solution for providing ground reinforcement with tree protection areas. It confines fill material within its strong flexible cell structure in order to provide a stable base for traffic and an even load distribution (Figure 3 and 4). A big advantage of Terram Geocell over other products is that the geotextile material is permeable and allows lateral movement of air and water.

Terram Geocell is suitable for permanent woodland trails, paths, driveways, roads and parking areas.

It may also be used as temporary ground reinforcement where access to a site is limited by the presence of trees. Once operations on site are completed the temporary surface can easily be removed and the ground left undamaged.



No ground reinforcement: Unreinforced soil becomes compacted and rutted by vehicle loads



Geocell ground reinforcement: Forces are spread Laterally reducing loads on the underlying soil

Figure 3. The Geocell Distributes loads evenly In order to prevent rutting

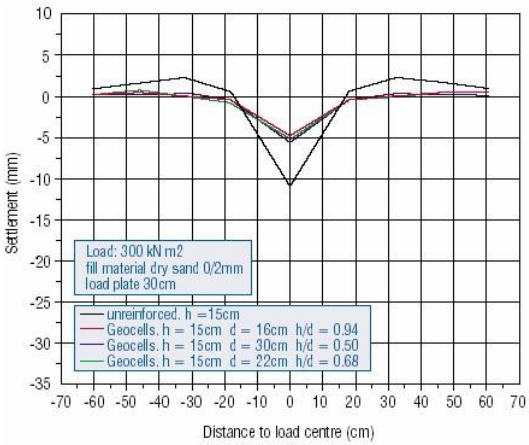


Figure 4. Static loading tests of up to 300kN/m2 revealed only minimal deflection (<5mm) of the surface of filled Geocell

Getting the design right

Every application will be slightly different so it is important to have the input of an engineer and arboriculturist together in order to design the right solution for an installation near to trees. The Arboriculturist will be able to advise on tree protection issues and the engineer will be able to specify details such as cell depth, fill type (Figure 5) and load bearing capacity.

For example, the design of a pedestrian footpath may be less rigorous than that of an access road that may have to withstand the load of a heavy crane or lorry.

But there are some principles that should be considered in every application (see Figure 6):

- The ground must be protected at all stages during installation – there is no point in installing a ground protection system where soil or roots have already been damaged by other site activities
- Terram Geotextile should be used underneath the Geocell to prevent fill materials penetrating the soil
- The fill material should be granular and should permit water and air flow
- Any edgings should be carefully designed to avoid excavation and root severance
- A permeable and gas-porous wearing course should be installed above the Geocell
- In most case the driveway or parking area should not exceed 20% of the root protection area.

If correctly designed and installed the Geocell cellular confinement system should allow paths, drives and parking areas to be located within a tree's protection zone, thus enabling development that might not otherwise be permitted by local authorities.

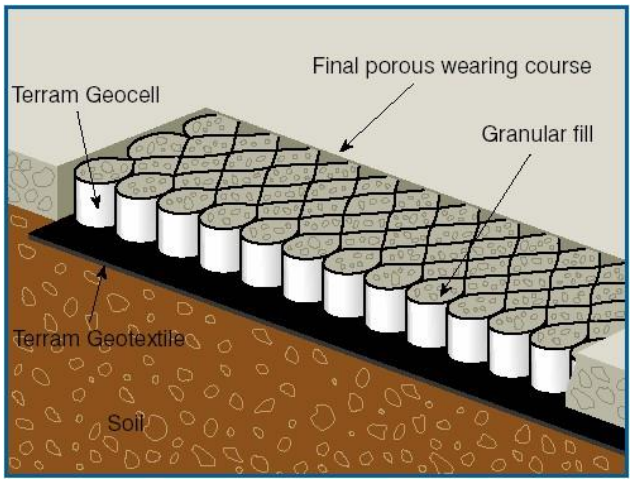


Figure 6. Components of an above-ground load bearing platform suitable for vehicles

Example installation Driveway construction

1. Remove grass and other vegetation and the upper organic layer Of soil by hand digging. Arisings should be wheel-barrowed out of the tree protection area. Machinery (even low ground pressure tracked vehicles) should not be used due to the danger of soil compaction
2. Small depressions may be filled with sharp sand
3. Lay out Terram Geotextile over the driveway area
4. Lay out Terram Geocell and carefully peg in place
5. Fill the cells working from the area furthest from the trees first. Further filling should be carried out using the filled Geocell as a platform
6. Install a permeable wearing course, e.g. porous tarmac, block paviours on a sharp sand base (a further layer of Terram above the filled Geocell will be needed in this case to prevent the sand mixing with the granular fill below).

Conclusion

BS5837 Trees in Relation to Construction and APN1 allow the careful development of paths, drives and roads within the root protection area of trees provided an above-ground, no-dig construction is used.

The use of Terram Geocell as a ground reinforcement Platform is Therefore and Ideal solution that can facilitate such development near to tree which might not otherwise be permitted due to fears of damage to soil structure and tree roots.

Further reading

BS 583: 2005 Trees in relation to construction – Recommendations. British Standards Institution.

Dobson, M. (1995): Tree Root Systems. Arboriculture Research and Information Note 130/ARB/95. Arboricultural Advisory and information Service, Farnham.

Patch, D. and Dobson, M. (1996). Driveways Close to Trees. Arboricultural Practice Note 1. Arboricultural Advisory and Information Service, Farnham.

Nicholson, R. (2001). APN1, BS5837 & PPG 3, Guidance for Trees: Conflict or Complement? Arboricultural Journal 25, 361-376.

Products Available	Panel size	Depth	Cell Diameter
Erocell 22/20	**5.0m x 10.1m**	**200mm**	**220mm**
Erocell 25/15	**7.0m x 10.0m**	**150mm**	**250mm**
Erocell 25/10	**7.0m x 10.0m**	**100mm**	**250mm**

The cell depth and diameter is dependent upon specific site conditions

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Recommendations for use are a guide and purchasers must determine the suitability of the product for their intended use. Terram Ltd assumes no liability for claims beyond the replacement value of the product.

The instructions contained here are a general guide only and therefore cannot cover all aspects involved or all possible uses of Terram Cellular System. If you are not experienced in carrying out projects of the type Terram Cellular System is designed for, you should seek advice from someone appropriately qualified. Any recommendations or suggestions (including design guidance) given by or on behalf of Terram on the use of its products for particular applications are given in good faith and (unless otherwise agreed) free of charge, but it remains your responsibility to ensure the use is appropriate and the product correctly installed. Terram, its agents and employees, accept no responsibility for guidance or advice given. Terram guarantees that this product is in accordance with its specification and if not Terram will at its option supply replacement product or reimburse the price paid for it. This states Terram's entire liability, all other liability and responsibility is excluded. THIS DOES NOT AFFECT THE STATUTORY RIGHTS OF A CONSUMER.

7. MultiTrack Ground Guards Specification

MultiTrack

THE UNBREAKABLE ORIGINAL

Watch this short video to see MultiTrack in action.

MultiTrack mats are the strongest in their category

Mats are easily moved using a HandiHook

Standard no-tools joiners quickly clip the mats together

Low profile joiners for walkways plus bolted joiners

SafeStore stillages hold 25 mats

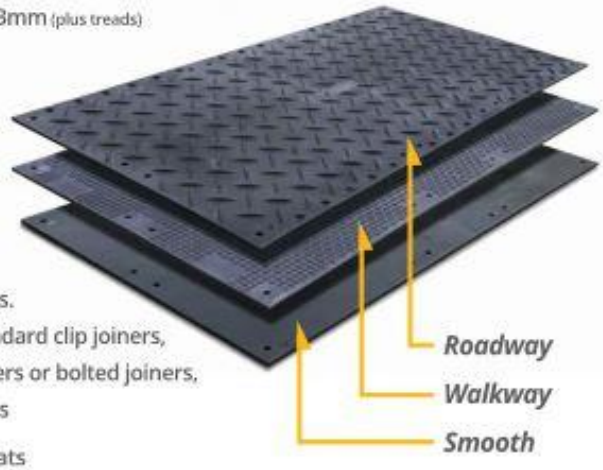
Material: Special blend of HDPE recycled plastic, fully recyclable

Overall Size: 2435 x 1215 x 13mm (plus treads)

Surface Area: 2.95m²

Weight: 39kg

Tread Options: Roadway, Walkway and Smooth, or a combination



Connectors: 10 joining points. A choice of standard clip joiners, low profile joiners or bolted joiners, plus anchor pins

Packed in: Stillage of 25 mats

Stillage Pack: **Weight:** 1105kg
Dimensions: 2550 x 1260 x 900mm

Fire Rating: UL94 HB

Slip Testing: BS7976 part 2

Deflection: Tested on varying CBR ground conditions using a 300mm diameter steel platen with 6 tonnes load to simulate the pressure of an HGV wheel

Ground CBR 11.35% : Deflection 17.68mm

Ground CBR 8.58% : Deflection 20.41mm

Ground CBR 4% : Deflection 22.00mm

Guarantee:

MultiTrack temporary roadway mats are guaranteed for life against breakage up to 120 Tonnes UDL (Uniformly Distributed Load).

It is the user's responsibility to assess the load-bearing capacity of the ground, and to only operate vehicles within the weight that the ground is capable of safely supporting. Ground-Guards Ltd accepts no liability whatsoever for any damage, loss or injury arising from the ground conditions on which these products are used.

MultiTrack mats are not suitable to use for bridging purposes. Damage caused by mechanical equipment (e.g. cuts by digger buckets) or sharp protrusions beneath the mats is not covered by this guarantee.

120 TONNES UNBREAKABLE GUARANTEED
* See www.ground-guards.co.uk

Ground-Guards®

www.ground-guards.co.uk
+44 (0) 113 267 6000
info@ground-guards.co.uk

8. Air Spade/Air Excavation Specification

The largest specialist Arboricultural suppliers in the North of England.
UK Distributors to the Tree Care Industry of the AIR-SPADE®
AIR EXCAVATION TOOL
Industrial / Construction Applications

Industrial / Construction Applications

AIR-SPADE® is the ideal tool for contractors, utility companies and everyone practicing safe excavation. Common uses include:

Pot holing

Utility line Locating

Crack Cleaning

Valve box cleaning

Utility Installation

Line spotting for backhoe

Vacuum excavation

Trench rescue

Meter locating

Full Range of Parts Available

AIR-SPADE® Series 2000 tool *

2 ft. 3 ft, 4 ft or 5 ft. extensions

Custom length barrel
Extra 15, 25, or 60 scfm nozzle
Extra 105 or 150 scfm nozzle
Extra 225 scfm nozzle
45o Angled Adapter
Arboricultural
Applications Benefits
AIR-SPADE® Handle

10 Ft. Lightweight Hose
25 Ft. Lightweight Hose
50 Ft. Lightweight Hose

Scratch Proof Face Shield

Spare Parts Kit
Storage Case with lock
* includes handle, 150 cfm / 90 psi nozzle, and 4 foot barrel.

Why does the AIR-SPADE® out perform other air tools?

In head to head tests, the AIR-SPADE® dislodged harder clay soil and dug faster than other air digging tools. Soil fractures from compressive stress, tons per square foot (tsf), exerted on its surface. As shown above for the same pressure and flow, compressed air exiting from a pipe nipple, orifice, or improperly designed nozzle expands outward rapidly to 3 to 4 times the area versus the jet from the patented supersonic nozzle in the AIR-SPADE®. The flow from these competitors can even go sub-sonic as indicated by the presence of a "Mach Disk," which can be seen in the flow if the light is right

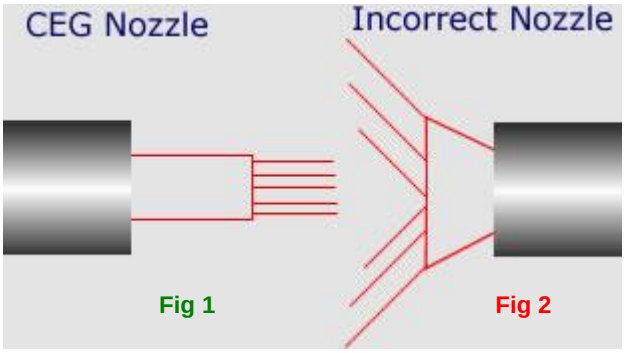
Arboricultural Applications	Benefits
AIR-SPADE® is used by arborists and landscape professionals worldwide for:	• Digs faster and harder soils than competitive or home made wands
Root Collar Excavation	• Less worker fatigue/injuries than a pick or shovel
Plant Aeration	• Faster and safer than hand digging
Vertical Mulching	• Saves expensive hourly labour costs
Soil Compaction Relief	• Non-damaging to all kinds of buried utilities or plant roots
Disease diagnosis and treatment	• Digs without making mud and does not create "contaminated" spoil like water
Transplanting	• Excavated soil is ideal for recompaction
Bare rooting	• Modular design with parts that screw together without tools
Damage analysis	• Interchangeable nozzles sized to match air compressors from 15 to 250 scfm
Locating Roots in New Construction	• Interchangeable extensions to 8ft and reducers to 2 ft
Root Pruning and Structure Analysis	• Ergonomic handle with thermal shield and pressure gauge
Running utilities through the root zone	• Safety "dead Man" trigger with guard
Radial trenching	• Electrically insulating barrel
	• Hardened wear resistant stainless steel nozzle
	• 45 deg adaptor

Will higher pressure make the AIR-SPADE® work Better?

Increasing the air pressure above 90 psi on a properly designed supersonic nozzle does not lead to a proportional gain in excavation capability. For example, doubling the nozzle pressure to 180 psi increases the air jet force by only 10% and the exit momentum flux (stress seen by the soil) by only 45%. Supplying higher pressure to a nozzle designed to work at 90 psi actually un-focuses the air jet degrading performance and consuming more air.

Patented CEG Supersonic nozzle turns 90 psig compressed air into laser-like Mach 2 jet. Jet penetrates and fractures friable materials like soil but harmlessly goes around buried pipes, cables, fibre optic lines and tree roots.

How Does it Work?



Jet from CEG nozzle focuses all of its energy and momentum onto concentrated spot on the soil. **Fig 1**

Air from pipe nipple, orifice, or improperly designed nozzle, expands greatly reducing its effectiveness. **Fig 2**

In what types of soil will an AIR-SPADE® work?

Because of its unique, focused air-jet, the **AIR-SPADE**® works in most soils, even hard clays. Cohesive soils can be classified and described by unconfined compressive strength as shown below. Tests have shown the **AIR-SPADE**® to be effective in compacted soils with unconfined compressive strengths well above the values listed to the right for hard clay.
Watering the work area ahead of time can be helpful sometimes. Watering reduces airborne dust if the soil is extremely dry. It also reduces the soil's strength making the digging easier. Combined use of the **AIR-SPADE**® with a low pressure water jet is effective even with extreme cases of highly compacted or sun-baked soils.
The **AIR-SPADE**® in general will not cut through rock, since its unconfined compressive strength is much greater than for soil. In fact, soil results from the physical and chemical breakup of weathered rock. Shales, however, may be broken apart by the **AIR-SPADE**® if the jet is directed between the laminations of the rock. Similarly, the **AIR-SPADE**® will not dislodge hard frozen soil which may behave like pavement or concrete.

Type	Unconfined Compressive Strength tsf		Description Cohesive soils including:
A	>= 1.5	stiff	Clay, silty clay, sandy clay, clay loam, caliche, hardpan, and sometimes silty clay loam and sandy clay loam.
B	<1.5 and >0.5	med	Granular cohesive soils like angular gravel, silt, silt loam, sandy loam, and sometimes silty clay loam and sandy clay loam.
C	<= 0.5	soft /v.soft	Granular soils such as gravel, sand, loamy sand, submerged soil, or soil from which water is freely seeping.

What size nozzle should I use?

Nozzles are available that use from 15 to 225 cfm of compressed air. The amount of soil that can be dislodged in a given amount of time is roughly proportional to the amount of air used. The 150 cfm nozzle is the most commonly used size for arboricultural and industrial applications. It has good productivity and is designed to run from the most common size of portable air compressor, a 175 to 185 cfm unit

Pressure Loss (psi) for 50 feet of common air hose

FLOW 9CFM

Hose ID	25	60	105	150	225
¾"	0.3	1.6	5.6	12.3	25.0
1"	0.1	0.4	1.3	2.8	5.5
11/4"	0.0	0.1	0.4	0.8	2.0

Excavation Rates (cu ft / min)

Nozzle Air Flow (CFM)	Soil Type A	Soil Type C
15	0.5	0.2
25	0.9	0.4
60	1.1	0.7
105	1.5	0.9
150	1.8	1.2
225	2.3	

Recommended Compressor Size

Nozzle (cfm)	Flow Rating (cfm) at 100 psi
15	15
25	25 - 30
60	60 – 70
105	125
150	175 – 185
225	250

How should I dig with the AIR-SPADE® ?

The **AIR-SPADE**® will dislodge up to several inches deep in a medium to stiff soil. High-speed movies show that an air-jet penetrates and dislodges the soil in a fraction of a second. Unless the soil is highly compacted, dwelling on the same spot is unnecessary and tends to increase spray. The **AIR-SPADE**® can be moved over the soil surface at a rate of about 1 to 2 feet per second. When several inches of soil have been loosened, the soil should be removed to expose a fresh working face for the air jet. Vacuum suction, as provided by our AIR-VAC and SAFEX® units, is an excellent companion to the **AIR-SPADE**® since it is likewise non-damaging.

What size of air hose do I need to use the AIR-SPADE® properly?

Compressed air flowing through a hose experiences a drop in pressure from friction and constrictions. Friction loss is proportional to the length of the hose. The amount of air, its pressure, the hose inner diameter and its smoothness also determine the loss. The table below shows the pressure loss for 50 feet of common air hose with couplings as a function of size and nozzle flow, cfm, for air at a pressure of 90 psi. Generally, a 1-inch air hose is recommended for use with the AIR-SPADE®.

How much will it Cost?

Arbor Kit complete includes:

45deg Angled Adapter
10 Ft. Lightweight Hose
Storage Case with lock
Shipping/Carriage to Mainland UK
Excluding vat
£995.00 *

AIR-SPADE® Series 2000 tool

Shipping/Carriage to Mainland UK
Excluding vat
£775.00

*Prices are subject to exchange rate fluctuations

AIR-SPADE® Series 2000

Who can supply me with it – and How long will it take to arrive?

You can be using this tool within 6 days of ordering it, it will be delivered to your door, carriage paid (Mainland UK).

trees unlimited.co.uk

The largest specialist Arboricultural suppliers in the North of England
Import the

AIR-SPADE®

Air Excavation Tool
&
Arbor Kit

CONTACT US NOW TO DISCUSS THIS INVALUABLE ADDITION TO YOUR WORKING TOOLS DO THE WORK FASTER - GET BETTER RESULTS !

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EMAIL info@treesunlimited.co.uk

FAX 0113 2295171

Appendix G

Haydens Drawing

- Arboricultural Impact Assessments
- Arboricultural Method Statements
- Tree Constraints Plans
- Arboricultural Feasibility Studies
- Shade Analysis
- Picus Tomography
- Arboricultural Consultancy for Local Planning Authority
- Quantified Tree Risk Assessment
- Health & Safety Audits for Tree Stocks
- Tree Stock Survey and Management
- Mortgage and Insurance Reports
- Subsidence Reports
- Woodland Management Plans
- Project Management
- Ecological Surveys

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