BS 5837:2012 Tree Survey, Arboricultural Impact Assessment, Draft Arboricultural Method Statement & Tree Protection Plan

The Six Bells
Ducks Hill Road
Ruislip
HA4 7TP

27th August 2020

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Appendices

1. Instruction

Usherwood Arboriculture have been instructed to provide a tree survey, arboricultural impact assessment, draft method statement and draft tree protection plan with regards to the proposal to provide 10 overnight B & B style accommodation bedrooms within the previously approved Barn type structure space, at The Six Bells, Ducks Hill Road, Ruislip, HA4 7TP. The survey has been carried out in accordance with BS5837:2012, Trees in relation to design, demolition and construction-Recommendations.

Drawing No.	Title	Drawn/Written by
VSA20 03- 001	Existing Site Plan	Vernon Smith & Associates
VSA20 03-006	Proposed Site Plan	Vernon Smith & Associates

Table 1. Drawings and documents supplied for consideration within this report

2.Executive Summary

This document takes into account the potential impact of development upon trees both within and In close proximity to the application site. For completeness, a total of 40 trees have been surveyed, although, the proposal will only impact upon eight individual trees, including the removal of three category C specimens. The remaining impacts will be in the form of additional parking spaces installed upon the root protection areas of retained trees, while these will be installed as part of a no dig construction. Details within the Draft arboricultural method statement and Draft tree protection plan will ensure that all remaining trees are afforded maximum protection throughout the development.

3.The Site

The application site is located on the west side of Ducks Hill Road and within an area of designated Green Belt. The site is largely level and arboreal in nature, surrounded by continuous canopy cover made up primarily of mature Oak and Ash to the north and west of the pub and restaurant car park.

Soil conditions.

The British Geological Survey, Geology of Britain viewer describes the local bedrock geology as Lambeth Group- clay, silt and sand, and the superficial layer as Alluvium-Clay, silt, sand and gravel.

Legal Constraints

Trees can sometimes be the subject of a Tree Preservation Order (TPO) or a property may be situated within a designated conservation area. Both a TPO and conservation area designation require the owner/occupier or those wishing to work on trees to seek the Council's consent or provide written notice prior to carrying out any works. It is a criminal offence to carry out any works to protected trees without the Council's consent. I have been informed by Hillingdon Council that the site is not subject to a tree preservation order.

Aerial image courtesy of Google Maps with site outlined in red.

4. Tree Survey

Trees were assessed in accordance with recommendations and guidelines contained within British Standard 5837:2012 - 'Trees in relation to design, demolition and construction-Recommendations' henceforth referred to as BS5837. The survey was carried out in relation to the condition and quality of trees growing either within or near the boundary of the site. Where details have been omitted including the heights of crown break and the direction of the first major lateral branch, these details were not seen as being relevant to this application. Where access allowed, tree heights were measured with a Haglof electronic clinometer and trunk diameters with a diameter tape measure. Crown spreads were measured with a tape measure at the four cardinal points.

All trees were assessed from the ground utilizing the Visual Tree Assessment method as developed by Mattheck and Breloer (The Body Language of Trees, Research for Amenity Trees No 4 Department of the Environment).

This tree survey should not be treated as a hazard assessment, it has been carried out to inform the planning process with regards to the appropriate retention and protection of trees as visual and ecological assets within the landscape. However, where clear and obvious defects have been observed, the relevant parties have been informed.

Tree Assessment and Categorization

Tree quality ratings have been assessed in accordance with BS5837's Table 1, Cascade chart for tree quality assessment.

U= Trees in such a condition that any existing value would be lost within 10 years and which should in the current context, be removed for reasons of sound arboricultural management. (Trees that have serious, irremediable structural defects, such that their early loss is expected due to collapse or ill health including trees that will become at risk due to the loss of other U category trees).

A = Trees of high amenity quality and value in such a condition as to be able to make a substantial contribution (a minimum of 40 years is suggested).
1) Trees that are particularly good examples of their species if rare, unusual or essential components of groups or formal or semi-formal arboricultural features.
2) Trees, groups of trees or woodland which provide a definite screening or softening effect to the locality in relation to views in or out of the site, or those of particular visual importance.
3) Trees groups or woodlands of significant conservation, historical, Commemorative or other value (e.g. veteran tree or wood pasture).

B = Trees of moderate quality and amenity value: those in such a condition as to be able to make a significant contribution (a minimum of 20 years is suggested).
1) Trees that might be included in the high category but are down-graded because of impaired condition (e.g. remediable defects).
2) Trees, groups of trees or woodland that form distinct landscape features but do not form essential components of the landscape.
3) Trees with clearly identifiable conservation or other cultural benefits.

C = Trees of low quality and amenity value currently in adequate condition to remain until new planting is established (a minimum of 10 years is suggested) or trees under 150 mm stem diameter.
1) Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories.
2) Trees presenting groups or woodlands but not with a significantly higher landscape value and or offering low or temporary/transient screening benefit.
3) Trees with no conservation or other cultural benefits.
Note: Category C trees are the least suitable for retention, where they would impose a significant constraint on the development their removal for development purposes may be considered acceptable by the LPA.

5.Tree Survey Data & Appraisal

This survey concerns 40 individual trees, full details of the survey data can be found in the Tree Survey Schedule at **Appendix 1**. An explanation of Tree Quality category ratings is set out on the previous page.

Category A individual trees and groups of trees.
No individual trees were graded as category A (trees of high quality) as part of this survey.

Category B individual trees and groups of trees.
21 individual trees and were graded as category B (trees of moderate quality) as part of this survey.

Category C individual trees and groups of trees.
17 individual trees were graded as category C (trees of low quality) as part of this survey.

Category U individual trees and groups of trees.
Two individual trees were graded as category U (trees unsuitable for retention) as part of this survey.

Seven tree species were recorded as part of this survey, there common and botanical names are set out within the table below.

Common Name	Botanical Name
Common Ash	Fraxinus excelsior
Dawyck Beech	Fagus sylvatica 'Dawyck'
Field Maple	Acer campestre
Hazel	Corylus avellana
Pedunculate Oak	Quercus robur
Norway Maple	Acer platanoides
Plum	Prunus domestica

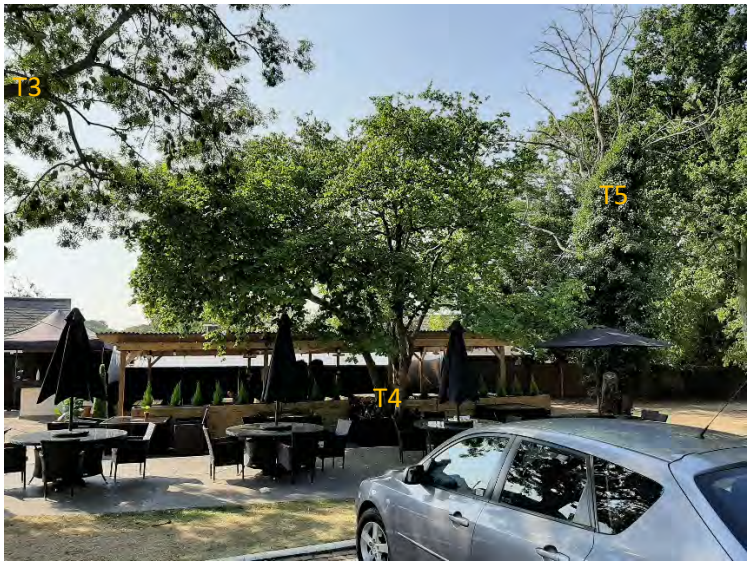
Table 2. Tree species recorded on site and their botanical names

T3, Common Ash


Photos above of T3, a mature Common Ash.

T3 Ash is a mature category C tree that will remain alongside the proposed development. The tree divides into two stems at 3 metres and currently provides support for festoon lighting in the pub garden. The overall condition of T3 suggests the early stages of Chalara Ash dieback.

T4 Hazel

Photos above of T4, a mature multi-stem Hazel encased in a wooden planter. T5, an Ivy-clad dead Ash tree can be seen to the right and will be removed due to its hazardous condition.

T4 Hazel is a mature category C multi-stemmed tree of limited merit. The tree originates at ground level having had a raised planter with additional soil retrofitted around its base. T4 will be removed to facilitate the proposed development.

T6, T7 & T8 Pedunculate Oaks and multi-stemmed Hazel.

Photo above shows T6, T7 & T8, two category B Oaks and a category C Hazel.

T8 Hazel is an unremarkable mature, multi-stemmed category C Tree. T8 will be removed in order to facilitate the installation of additional parking.

T9 Dawyck Beech

Photos above showing T8 Hazel and T9 Dawyck Beech.

T9 is an upright form of beech known as Dawyck Beech. The tree has a very asymmetrical canopy, suppressed from by the larger and more mature trees around it. T9 is another unremarkable category C tree in the early mature stage of its life and will be removed in order to facilitate the installation of additional parking.

T10 Common Ash

Photos above of T10, category C Ash and T11 category B Oak.

T10 Ash is an early mature category C tree in poor structural condition. T10 exhibits basal decay and vertical cracking on its main stem before dividing into two stems at 2 metres where the cracks or cankers continue. As with T3, the overall crown condition suggests the early signs of Chalara Ash dieback. T10 will be retained and integrated within the proposed additional parking area.

Chalara Ash Dieback-

Ash dieback is a relatively recent disease to arrive in the UK. The disease originated from Asia before arriving in Europe where it is currently devastating the European Ash (Fraxinus excelsior) population. The disease more correctly known as Hymenoscyphus fraxineus could kill a large proportion of the UK's Ash trees, with younger trees showing a higher vulnerability to the disease. A number of Ash trees throughout the site are exhibiting crown dieback associated with this disease in its various stages.

6.Arboricultural Impact Assessment

The term Arboricultural Impact Assessment is self-explanatory. It sets out the potential risks and threats associated with proposed construction to trees both within and near to an application site and seeks to minimise those risks through the implementation of a sound and recognised methodology set out within an arboricultural method statement.

Construction and development in general can impact trees in a number of ways, the most notable being damage to the tree's root system leading to decline and potential structural instability. BS5837 recognises this and accordingly sets out recommendations to minimise damage associated with the effects of soil compaction and root severance.

The proposal to construct a barn style building with associated additional parking will have a minimal impact upon the arboreal nature of the site. A total of three category C trees of low quality are proposed for removal and a low impact solution will be sought to provide additional car parking spaces to the south-west of the existing block paved car park.

Trees to be removed

BS5837:2012 Category	Tree & Group Number	Reasons for removal
A	None	
B	None	
C	T4, T8, T9	T4 Will be on the edge of the footprint for the proposed development whilst T8 and T9 will be beneath the area chosen for additional parking.
U	T5, T16	Remove for sound arboricultural reasons.

Table 3: Trees to be removed for development.

Root Protection Areas

BS 5837 describes the root protection area (RPA) as a layout design tool indicating the minimum area around a tree deemed to contain sufficient roots to maintain the tree's viability, and where the protection of the roots and soil structure is treated as a priority.

The **Root Protection Areas (RPA)** have been calculated in accordance with Table D1 of BS5837:2012. Notional RPA's are plotted on the arboricultural impact assessment plan at **appendix 3**. The RPA is defined by the formula in paragraph 4.6 from the British standard and may be refined by considering current on-site constraints to root activity such as buildings, walls, earthworks, hard paving and services.

Root Systems and compaction

Root systems can easily be damaged during construction works, leading to the sometimes-rapid decline of valuable trees. The biggest problem for trees on or close to construction sites is the compaction of soil caused by inappropriate vehicular movement and storage of materials especially where the site is founded on a compressible clay.

Numerous surveys have shown that a significant proportion of a tree's roots proliferate in the top 600-1000mm of soil. There will of course be roots that may go down to depths of 3 metres or more although these will be in the minority. Roots in the upper soil surface find it far easier to intercept moisture, acquire oxygen and perform gaseous exchange. You also find that as soil depth increases so does its strength or compaction, making it harder for roots to elongate with new extension growth.

Root morphology differs from species to species and is largely dependent on the soil type and ground conditions, however the fine roots responsible for moisture and nutrient uptake can last anything from 10 days to over a year (Eissenstat and Yanai, 1997), with the tree

producing new fine roots on a regular basis. The larger and more structural roots are a permanent feature of the tree and convey moisture and nutrients from the soil via the fine roots, into the trunk and canopy. The larger roots are of course responsible for the tree's stability as well as being areas of carbohydrate storage. Younger trees are more able to adapt to change and have more potential energy to explore alternative rooting environments whereas more mature trees are slower to react to a changing soil environment and are adapted to expend their energy on other important functions.

The National Geology of Britain Viewer advises that the local soil comprises of a superficial layer of clay- silt, sand and gravel over Lambeth Clay. therefore the risk of soil compaction is considered to be moderate with regards to the installation of additional parking spaces.

Root severance

As mentioned above, the roots are responsible for a number of functions including stability and the transport of water and nutrients. Studies have shown that trees can withstand and recover from the loss of a proportion of their root systems, especially where those roots have been removed in a single direction. It is not expected that major roots will be encountered as sufficient distance has been allowed between the RPA's of retained trees and the proposed barn construction. It is also unlikely that any major roots will be compromised during the installation of additional parking.

Installation of additional parking

The finished surface is still under discussion, however, the criteria will be for a robust, porous and non-invasive product that blends with the natural setting.

Usherwood Arboriculture has previously used Cellpave 40 from Groundtrax
https://www.groundtrax.com/*cellpave-40*-porous-plastic-pavers

Tree Pruning Works

A separate tree pruning specification is being prepared, focussing primarily on dead wood removal from mature Oak trees that overhang the proposed additional parking area.

7.Arboricultural Method Statement (AMS)

The arboricultural method statement sets out a precautionary approach towards tree protection. Any operations including access, proposed within the RPA (or crown spread where this is greater) should be described within an arboricultural method statement, to demonstrate that the operations can be undertaken with minimal risk of adverse impact to retained trees.

The methodology will provide sufficient protection to the rooting environments of all trees within the vicinity of the proposed construction throughout the duration of works.

Phase 1-Access facilitation and pre-start tree works.

- Project arboriculturalist to mark out locations for tree protective fencing.
- Project arboriculturalist to meet with tree surgeons and mark up trees T4, T5, T8 & T9 for removal.
- Tree surgeons to carry out tree felling works including the removal of all stumps with a mechanical grinder.

Phase 2- Installation of protective fencing.

- Erect protective barrier fencing in locations shown on the tree protection plan at appendix 4. Tree protection positions will have already been marked out by the project arboriculturalist during phase 1. A protective fencing diagram can be found at appendix 5. Barriers will consist of a heras type panel inserted into rubber 'elephants feet'and reinforced with a stabelizer strut. Two clamps either end of each section will ensure the area within the fence (CEZ) remains out of bounds to demolition activities throughout the duration of works.


Photos above show protective fencing installed as per BS5837:Fig 3A with rubber feet and stabilizer struts.

Phase 3- Construction of barn

- Once the tree protection measures have been implemented, construction works may commence in the standard manner.
- Construction materials will be delivered and stored upon the existing hard surfacing of parking bays set aside for this purpose.
- Excavation spoil will also be stored upon the hard surfacing of parking bays prior to being carted away from site.

Phase 4- Installation of additional parking spaces

- Additional spaces are to be installed upon the existing ground level.
- Any hollows or undulations are to be back filled with sharp sand, prior to the laying of a porous geotextile membrane.
- Refer to the installation specification for the chosen product, to be confirmed.
- All works are to be carried out by hand and there will be no requirement for the use of tracked or mechanical construction machinery, other than the use of a whacker plate to consolidate a type 3 open aggregate sub base.

Site supervision and pre-commecement meeting

- The pre-commencement meeting should take place following the erection of protective fencing, this is in order for the project arboriculturalist to clarify that tree protection measures have been correctly implemented prior to the commencement of construction works.
- The project arboriculturalist will be available at all times to advise on any issues that may arise should further tree roots be encountered.

General measures to be adopted in proximity to trees-

- All tree protection measures will be set in place prior to commencement of any works relating to the approved planning consent.
- No bonfires on site.
- No storage of products or mixing of materials within the RPA's of trees.
- No materials are to be stored within the confines of the protective fencing (CEZ).
- Storage of materials on soft ground in proximity to any other trees and hedges away from construction is to be avoided.
- No discharging of any products associated with construction near trees or hedges
- No refueling/topping up of hydraulic fluids etc. on plant machinery within or close to the RPA of trees.
- There will be no lowering or raising of soil levels within the root protection areas of retained trees except where specified and agreed by the LPA.
- There will be no excavation or trenching for the installation of services within the root protection areas of retained trees.

Dealing with exposed roots

- In the unlikely event that roots from existing and retained trees are encountered, the following protocol should be observed.

If any tree roots are encountered during the excavation process, roots up to 25mm shall be cut back with a sharp pair of by-pass loppers, except where they occur in clumps. Roots occurring in clumps or of 25mm diameter and over should be severed only following consultation with the project arboriculturalist or Local Authority tree officer.

If substantial tree roots are to be left exposed for any length of time, these must be covered with a damp hessian rap to minimize desiccation. Hessian should be removed immediately prior to backfilling with a suitable soil or sharp sand, not builders sand which contains sodium, detrimental to tree roots.

Box 1. Dealing with tree roots found during excavation works.

8. Conclusion

Provided the measures set out within this document are adhered to, there should be no adverse impacts upon the arboreal character of the site or the health of any individual trees, other than those proposed for removal. I therefore suggest that this application should be regarded as being arboriculturally acceptable.

9. Qualifications & Experience

I have been involved in the horticultural and arboricultural industries for over 35 years, firstly as a contractor and for the 15 years as a Local Authority tree officer and consultant. I hold the AA Tech cert arb, and ND Arb (RFS) as well as being a Lantra accredited Professional Tree Inspector. I am also a technical member of the Arboricultural Association and professional member of the Consulting Arborists Society.

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Appendix 1: Tree Survey Schedule

Trees have been listed on the schedule with both their common and scientific names.

Tree height is normally measured and rounded up to the nearest metre for trees above 10 metres in height using a Haglof electronic clinometer.

Stem or trunk diameters were measured using a diameter tape in mm at 1.5 metres above ground where access allowed, otherwise diameters have been estimated.

Crown spread has been measured in metres from the trunk to the tips of the live lateral branches taken at the four-cardinal points N-E-S-W using a ground tape.

Age Class
Young - Trees in the first fifth of full life expectancy
Semi-mature - Trees in the second fifth of full life expectancy
Early-mature - Trees in the third fifth of full life expectancy
Mature - Trees in the fourth fifth of full life expectancy
Post-mature – Trees having reached full life expectancy and trees in natural decline
Veteran - Trees of interest biologically, culturally and aesthetically due to certain features and/or age.

ERCY-The estimated remaining contribution in years calculated considering the tree's species, location, current age and physiological and structural condition at the time of the survey.

BS5837 Survey Data

Ref.	Species	Measurements	General Observations	Category	Recommendations
T001	Field Maple (Acer campestre)	Height (m): 7 Stem Diam (mm): 210 Spread (m): 2N, 2E, 2S, 2W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 2.5m. Area: 20 sq m.	
T002	Field Maple (Acer campestre)	Height (m): 7 Stem Diam (mm): 190 Spread (m): 2N, 2E, 2S, 2W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 2.3m. Area: 17 sq m.	
T003	Common Ash (Fraxinus excelsior)	Height (m): 14 Stem Diam (mm): 430 Spread (m): 5N, 5E, 5S, 5W Life Stage: Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 5.2m. Area: 85 sq m.	
T004	Hazel (Corylus avellana)	4 stems, diam(mm): 170, 250, 170, 180 Spread (m): 4N, 5E, 5S, 4W Life Stage: Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 4.7m. Area: 69 sq m.	
T005	Common Ash (Fraxinus excelsior)	Life Stage: Dead		U RPA None - due to Retention Category of U.	

Ref.	Species	Measurements	General Observations	Category	Recommendations
T006	Pedunculate Oak (Quercus robur)	Height (m): 14 2 stems, diam(mm): 380, 380 Spread (m): 5N, 5E, 5S, 4W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 6.4m. Area: 129 sq m.	
T007	Pedunculate Oak (Quercus robur)	Height (m): 14 Stem Diam (mm): 290 Spread (m): 2N, 3E, 5S, 5W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 3.5m. Area: 38 sq m.	
T008	Hazel (Corylus avellana)	Height (m): 7 13 stems, diam(mm): 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100 Spread (m): 5N, 4E, 4S, 5W Life Stage: Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 4.3m. Area: 58 sq m.	
T009	Dawyck Beech (Fagus sylvatica 'Dawyck')	Height (m): 15 Stem Diam (mm): 240 Spread (m): 2N, 2E, 2S, 2W Life Stage: Early Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 2.9m. Area: 26 sq m.	
T010	Common Ash (Fraxinus excelsior)	Height (m): 15 Stem Diam (mm): 400 Spread (m): 3N, 4E, 3S, 3W Life Stage: Early Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 4.8m. Area: 72 sq m.	
T011	Pedunculate Oak (Quercus robur)	Height (m): 14 Spread (m): 5N, 4E, 5S, 3W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA too small to calc.	
T012	Field Maple (Acer campestre)	Height (m): 7 Stem Diam (mm): 270 Spread (m): 3N, 3E, 3S, 3.5W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 3.2m. Area: 32 sq m.	

Ref.	Species	Measurements	General Observations	Category	Recommendations
T013	Field Maple (Acer campestre)	Height (m): 7 Stem Diam (mm): 230 Spread (m): 3N, 3E, 3S, 3.5W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 2.8m. Area: 25 sq m.	
T014	Field Maple (Acer campestre)	Height (m): 7 Stem Diam (mm): 220 Spread (m): 3N, 3E, 3S, 3.5W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 2.6m. Area: 21 sq m.	
T015	Common Ash (Fraxinus excelsior)	Height (m): 18 Stem Diam (mm): 650 Spread (m): 8N, 7E, 5S, 5W Life Stage: Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 7.8m. Area: 191 sq m.	
T016	Plum (Prunus domestica)	Life Stage: Mature Rem. Contrib.: <10 years		U RPA None - due to Retention Category of U.	
T017	Pedunculate Oak (Quercus robur)	Height (m): 14 2 stems, diam(mm): 390, 450 Spread (m): 2N, 6E, 9.5S, 3W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 7.1m. Area: 158 sq m.	
T018	Pedunculate Oak (Quercus robur)	Height (m): 14 Stem Diam (mm): 490 Spread (m): 2N, 8E, 5S, 3W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 5.9m. Area: 109 sq m.	
T019	Pedunculate Oak (Quercus robur)	Height (m): 14 Stem Diam (mm): 450 Spread (m): 2N, 3E, 7S, 3W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 5.4m. Area: 92 sq m.	

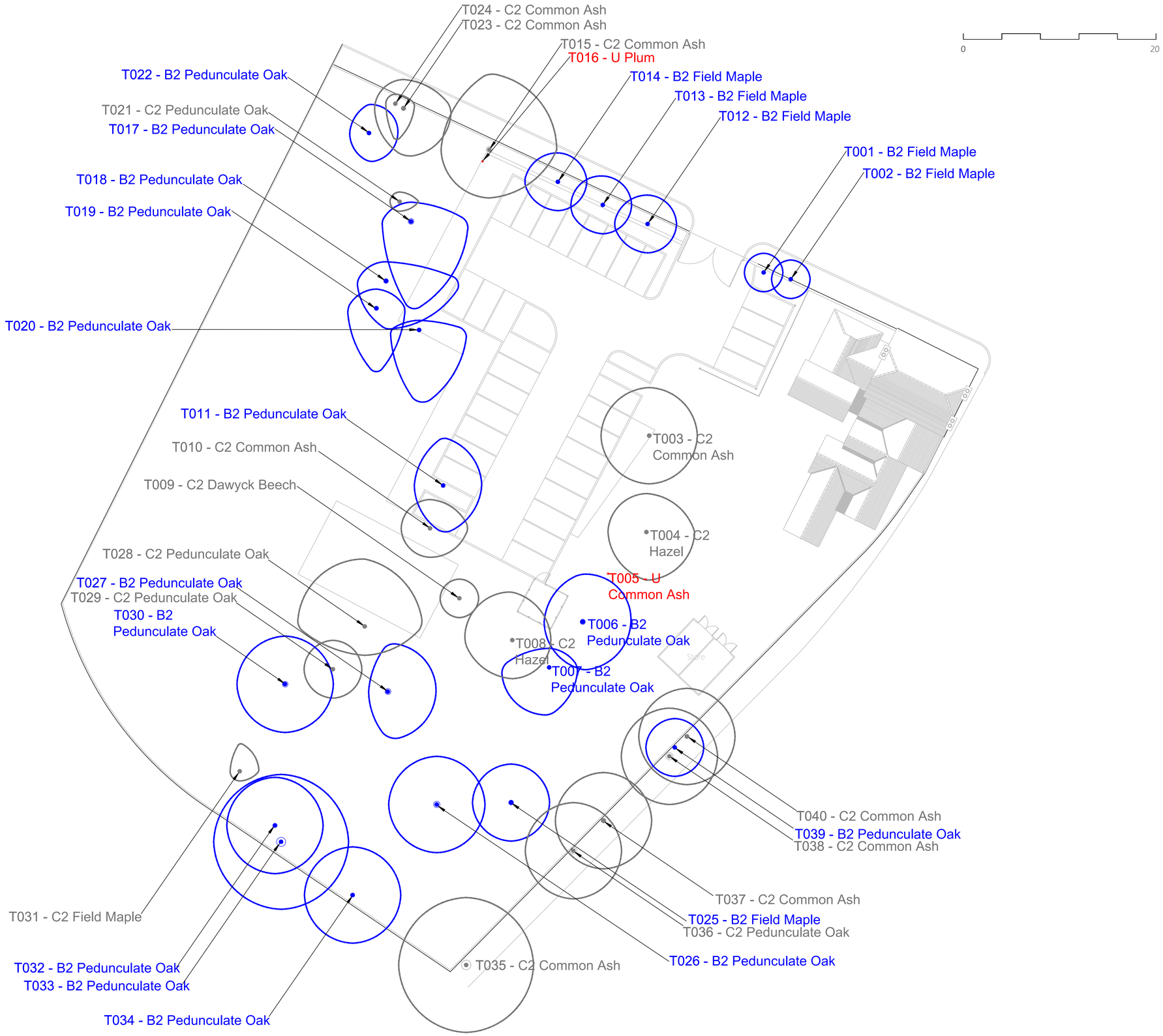
Ref.	Species	Measurements	General Observations	Category	Recommendations
T020	Pedunculate Oak (Quercus robur)	Height (m): 13 Stem Diam (mm): 430 Spread (m): 1N, 5E, 8S, 3W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 5.2m. Area: 85 sq m.	
T021	Pedunculate Oak (Quercus robur)	Height (m): 13 Stem Diam (mm): 240 Spread (m): 1N, 2E, 1S, 1W Life Stage: Early Mature Rem. Contrib.: 20+ Years		C2 RPA Radius: 2.9m. Area: 26 sq m.	
T022	Pedunculate Oak (Quercus robur)	Height (m): 14 2 stems, diam(mm): 320, 180 Spread (m): 3N, 3E, 3S, 2W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 4.4m. Area: 61 sq m.	
T023	Common Ash (Fraxinus excelsior)	Height (m): 14 Stem Diam (mm): 480 Spread (m): 3N, 5E, 5S, 3W Life Stage: Mature Rem. Contrib.: <10 years		C2 RPA Radius: 5.8m. Area: 106 sq m.	
T024	Common Ash (Fraxinus excelsior)	Height (m): 14 2 stems, diam(mm): 180, 180 Spread (m): 1N, 2E, 4S, 1W Life Stage: Early Mature Rem. Contrib.: <10 years	Structurally poor specimen	C2 RPA Radius: 3.1m. Area: 30 sq m.	
T025	Field Maple (Acer campestre)	Height (m): 14 4 stems, diam(mm): 280, 210, 250, 250 Spread (m): 4N, 4E, 4S, 4W Life Stage: Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 6.0m. Area: 113 sq m.	
T026	Pedunculate Oak (Quercus robur)	Height (m): 14 Stem Diam (mm): 660 Spread (m): 5N, 5E, 5S, 5W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 7.9m. Area: 196 sq m.	

Ref.	Species	Measurements	General Observations	Category	Recommendations
T027	Pedunculate Oak (Quercus robur)	Height (m): 17 Stem Diam (mm): 610 Spread (m): 5N, 5E, 5S, 2W Life Stage: Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 7.3m. Area: 167 sq m.	
T028	Pedunculate Oak (Quercus robur)	Height (m): 15 Spread (m): 7N, 6E, 3S, 7W Life Stage: Mature Rem. Contrib.: 10+ Years		C2 RPA too small to calc.	
T029	Pedunculate Oak (Quercus robur)	Height (m): 12 Stem Diam (mm): 370 Spread (m): 3N, 3E, 3S, 3W Life Stage: Early Mature Rem. Contrib.: 20+ Years		C2 RPA Radius: 4.4m. Area: 61 sq m.	
T030	Pedunculate Oak (Quercus robur)	Height (m): 17 Stem Diam (mm): 590 Spread (m): 5N, 5E, 5S, 5W Life Stage: Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 7.1m. Area: 158 sq m.	
T031	Field Maple (Acer campestre)	Height (m): 8.5 Stem Diam (mm): 280 Spread (m): 3N, 2E, 1S, 1W Life Stage: Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 3.4m. Area: 36 sq m.	
T032	Pedunculate Oak (Quercus robur)	Height (m): 12 Stem Diam (mm): 450 Spread (m): 5N, 5E, 5S, 5W Life Stage: Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 5.4m. Area: 92 sq m.	
T033	Pedunculate Oak (Quercus robur)	Height (m): 18 Stem Diam (mm): 940 Spread (m): 7N, 7E, 7S, 7W Life Stage: Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 11.3m. Area: 401 sq m.	

Ref.	Species	Measurements	General Observations	Category	Recommendations
T034	Pedunculate Oak (Quercus robur)	Height (m): 13 2 stems, diam(mm): 300, 290 Spread (m): 5N, 5E, 5S, 5W Life Stage: Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 5.0m. Area: 79 sq m.	
T035	Common Ash (Fraxinus excelsior)	Height (m): 18 Stem Diam (mm): 1000# Spread (m): 7N, 7E, 7S, 7W Life Stage: Mature Rem. Contrib.: <10 years		C2 RPA Radius: 12.0m. Area: 452 sq m.	
T036	Pedunculate Oak (Quercus robur)	Height (m): 14 3 stems, avg.(mm): 400 Spread (m): 5N, 5E, 5S, 5W Life Stage: Early Mature Rem. Contrib.: 20+ Years		C2 RPA Radius: 8.3m. Area: 216 sq m.	
T037	Common Ash (Fraxinus excelsior)	Height (m): 14 3 stems, diam(mm): 10, 350, 350 Spread (m): 5N, 5E, 5S, 5W Life Stage: Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 5.9m. Area: 109 sq m.	
T038	Common Ash (Fraxinus excelsior)	Height (m): 15 5 stems, diam(mm): 330, 330, 330, 330, 330 Spread (m): 5N, 5E, 5S, 5W Life Stage: Early Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 8.9m. Area: 249 sq m.	
T039	Pedunculate Oak (Quercus robur)	Height (m): 14 Stem Diam (mm): 300 Spread (m): 3N, 3E, 3S, 3W Life Stage: Early Mature Rem. Contrib.: 20+ Years		B2 RPA Radius: 3.6m. Area: 41 sq m.	

Ref.	Species	Measurements	General Observations	Category	Recommendations
T040	Common Ash (Fraxinus excelsior)	Height (m): 14 5 stems, diam(mm): 200, 200, 200, 200, 200 Spread (m): 5N, 5E, 5S, 5W Life Stage: Mature Rem. Contrib.: 10+ Years		C2 RPA Radius: 5.4m. Area: 92 sq m.	

Appendix 2: Tree Survey Plan



Site Plan: As Existing

1:200

KEY

Existing Trees:

- Category B Tree
- Category C Tree
- Category U Tree
- Root Protection Area

This drawing must be printed and used in colour

USHERWOOD ARBORICULTURE

Lawrence Usherwood

Tel. 01883 340398

Mobile 07753 211306

Email. lawrence@usherwoodarboriculture.co.uk

FOR PLANNING

Client: Vernon Smith Associates

Project: Six Bells, Ruislip

Drawing Title: Tree Survey Plan

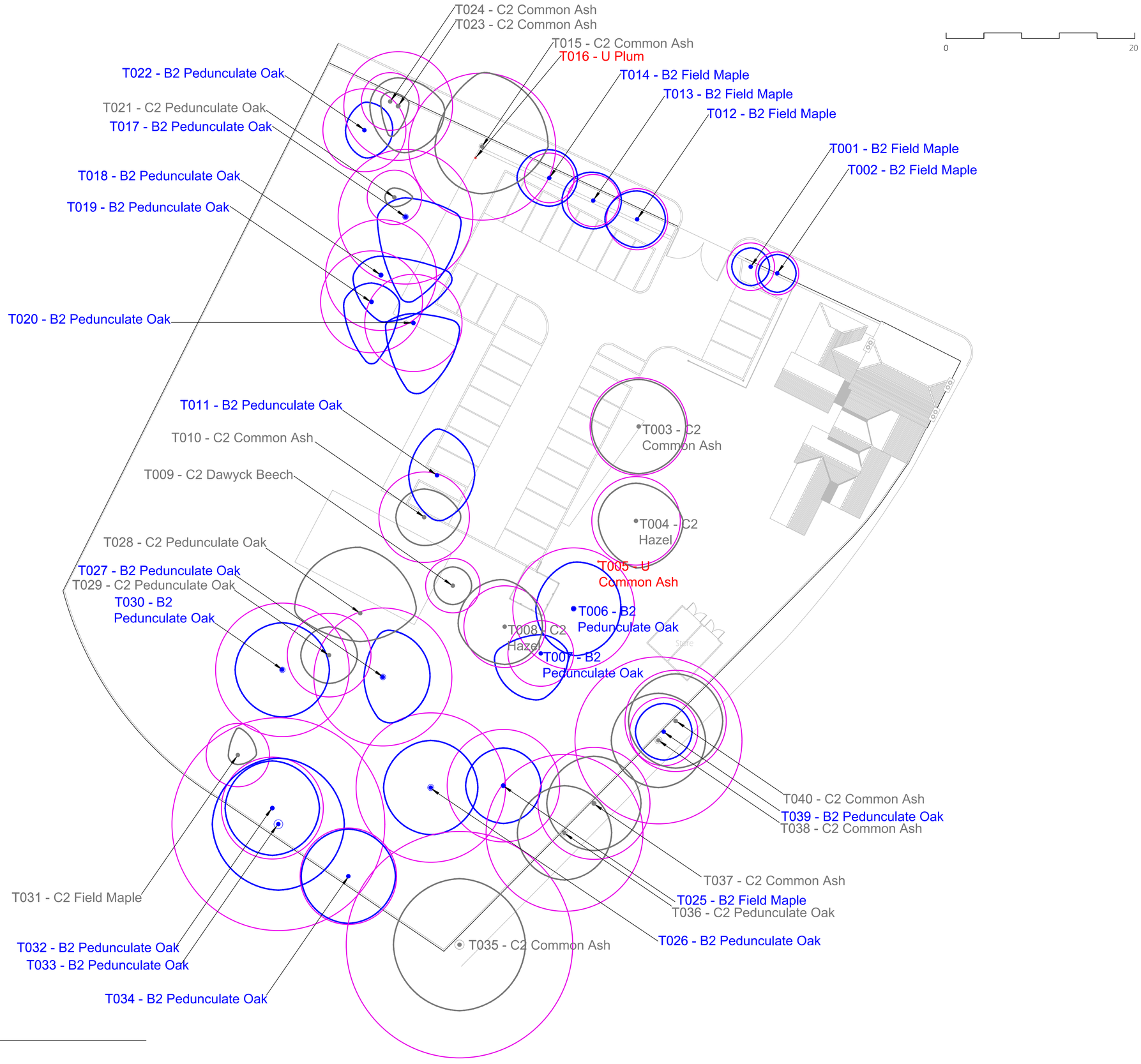
On base by: MVS Associates

Dwg No: UA/TSP1 | Scale: 1:200@A1

Drawn By: MP | Checked By: LU

Date:21/08/20

NOT FOR CONSTRUCTION



Site Plan: As Existing

1:200

KEY

Existing Trees:

- Category B Tree
- Category C Tree
- Category U Tree
- Root Protection Area

This drawing must be printed and used in colour

USHERWOOD ARBORICULTURE

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FOR PLANNING

Client: Vernon Smith Associates

Project: Six Bells, Ruislip

Drawing Title: Tree Constraints Plan

On base by: MVS Associates

Dwg No: UA/TCP1 | Scale: 1:200@A1

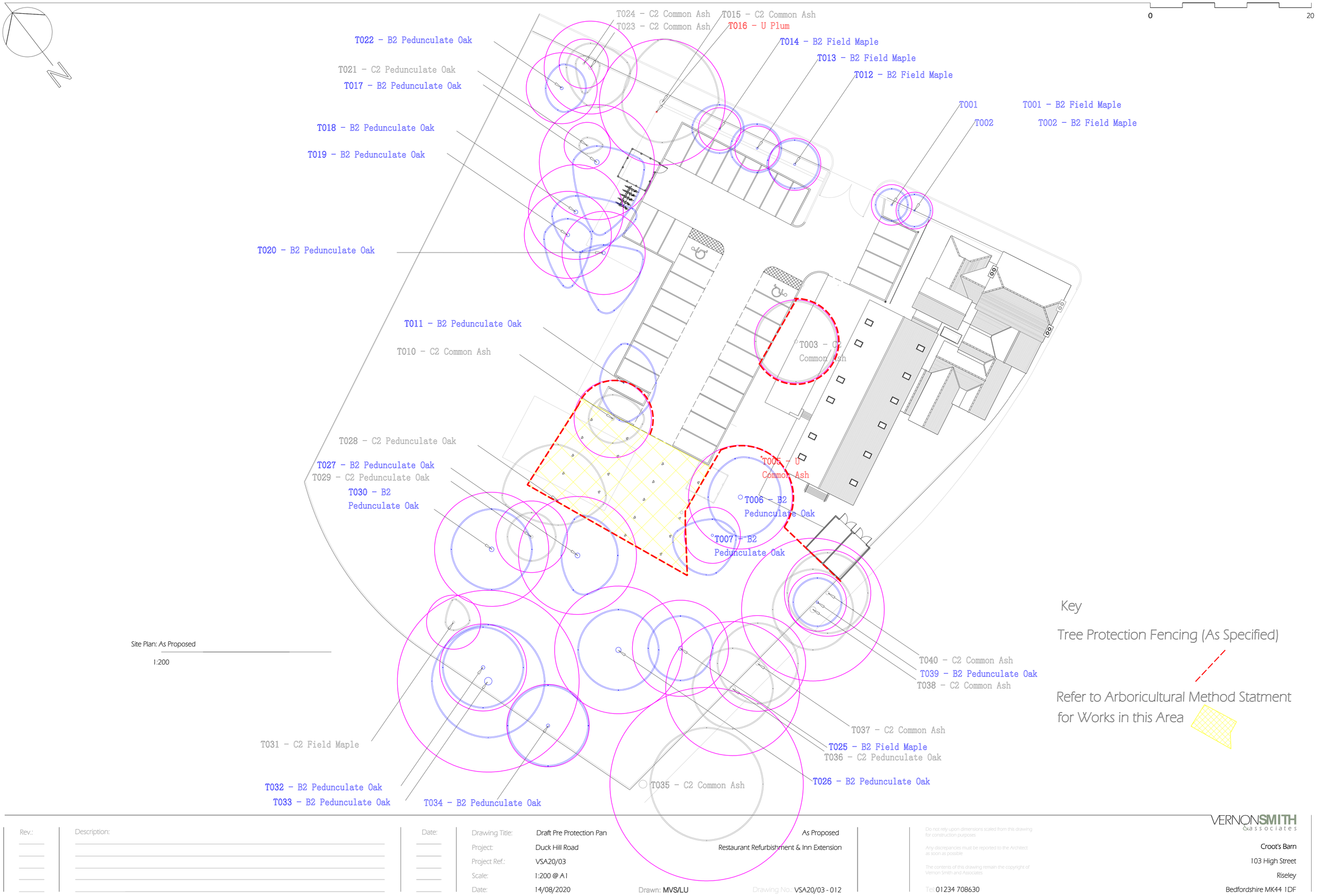
Drawn By: MP | Checked By: LU

Date:21/08/20

NOT FOR CONSTRUCTION

Appendix 3: Arboricultural Impact Plan

Appendix 4: Tree Protection Plan



Site Plan: As Proposed

1:200

Key

Tree Protection Fencing (As Specified)

Refer to Arboricultural Method Statment for Works in this Area

Rev.:	Description:	Date:

Drawing Title: Draft Pre Protection Pan — As Proposed

Project: Duck Hill Road — Restaurant Refurbishment & Inn Extension

Project Ref.: VSA20/03

Scale: 1:200 @ A1

Date: 14/08/2020

Drawn: MVS/LU

Drawing No.: VSA20/03 - 012

VERNONSMITH &associates

Croot's Barn

103 High Street

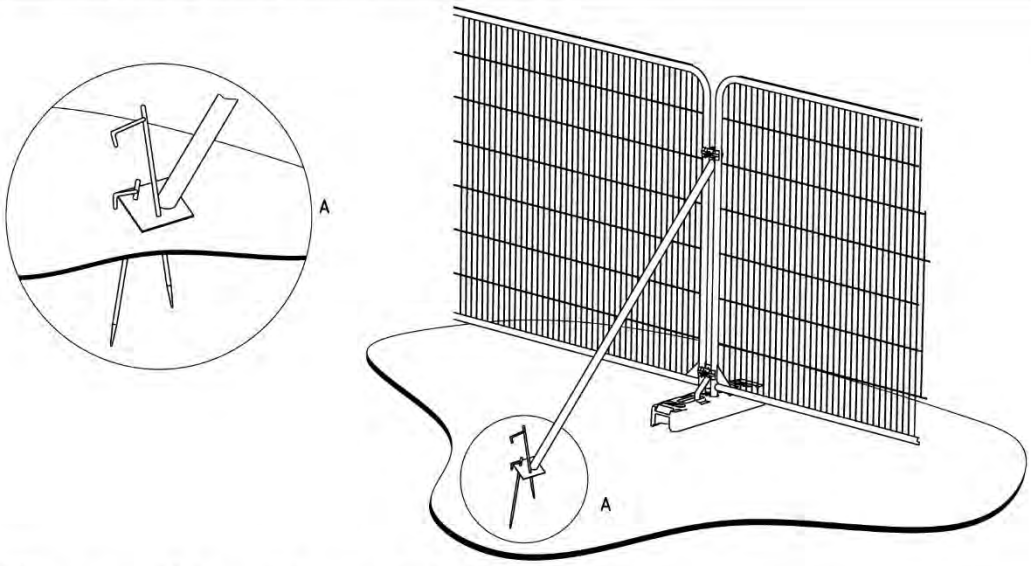
Riseley

Bedfordshire MK44 1DF

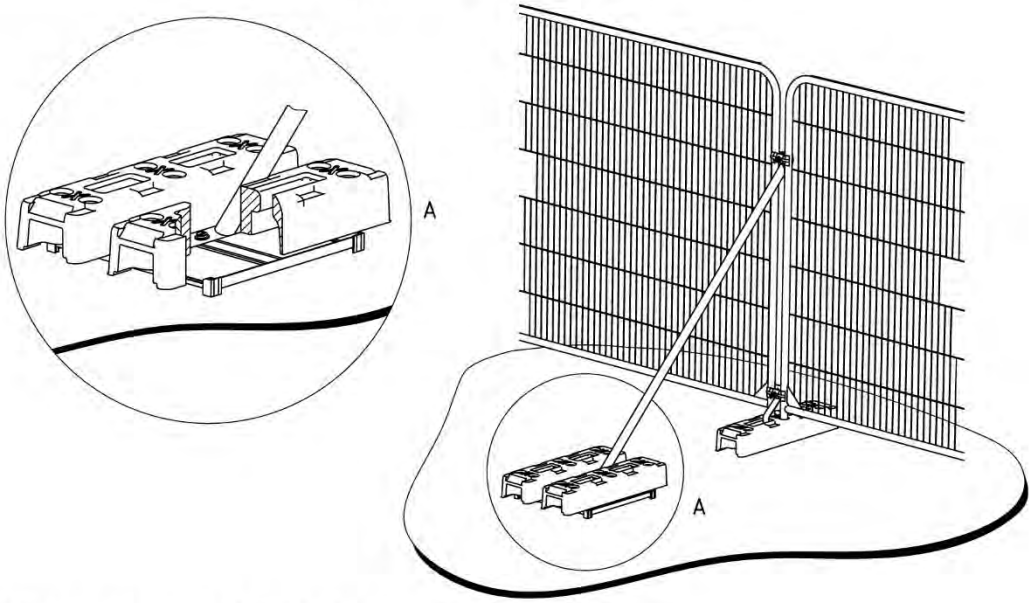
Tel: 01234 708630

Appendix 5: Tree Protective Fencing

Figure 3 **Examples of above-ground stabilizing systems**

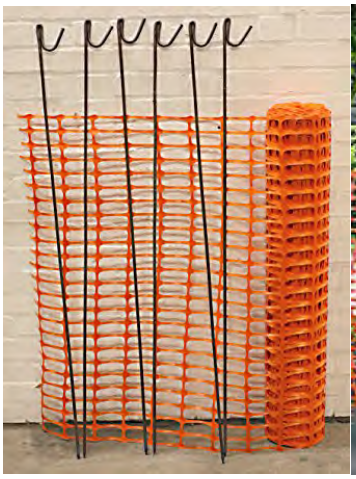


a) Stabilizer strut with base plate secured with ground pins



b) Stabilizer strut mounted on block tray

Protective fencing with stabilizers as per fig 3 (a).



Plastic mesh fencing held in place with road pins.

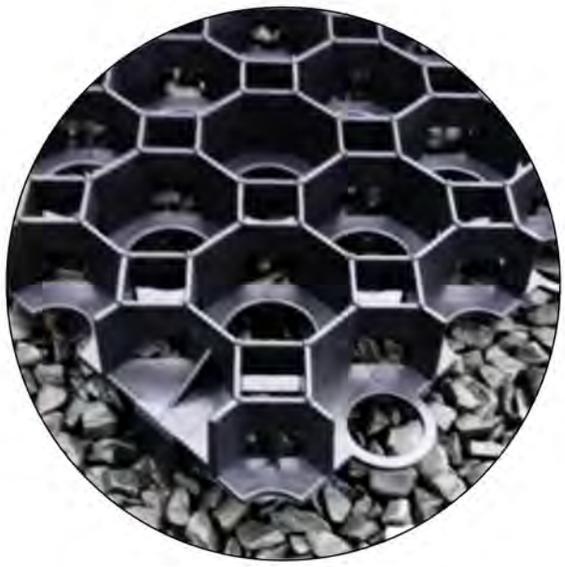
Appendix 6: Car Park Surfacing

GROUNDTRAX

CELLPAVE™ 40

INTERLOCKING CELLULAR PAVING GRID SYSTEM

CellPave™ 40 permeable paving grids are the perfect solution for park areas, driveways and paths.



MATERIAL

CellPave™ 40 permeable paving grids are an interlocking cellular paving grid system for grass and ground reinforcement. Manufactured from 100% recycled HDPE plastic, CellPave™ 40 permeable grass & gravel plastic pavers are supplied per sq/m. CellPave™ 40 grass pavers are a cost effective solution to worn & rutted grassed areas, displaced gravel and for Source Control of surface water run-off. CellPave™ 40 paving grids are designed to be installed onto a well prepared, free-draining and relatively even surface using either a 'Reduced-Dig System' or by employing a full sub-base construction incorporating a geogrid reinforcement layer.

HANDLING

You can cut CellPave™ 40 grids easily with a common angle grinder or jigsaw. The grass reinforcement paver grids have a very open cell structure allowing unrestricted healthy grass root growth and water infiltration and can be used as part of a sustainable urban drainage system (SuDS). The paver grids also incorporate 25mm 'ground-spikes' on the base which fix through the adjacent paving grid's edge-loops to provide the entire structure with firm anchorage and structural integrity and making them easy to install at rates of up to 100m² per hour.

CellPave™ 40 grass pavers should be installed onto a firm level sub-base (typically a DoT Type 3 or porous sub-base). The thickness of this base is dependant on the existing ground conditions and the design load specifications.

Please note that with all installations of grass pavers, it is strongly recommend that all areas should have sufficient drainage prior to installation. Failure to ensure this may result in the product not performing as intended.

PROPERTIES

- UV Stabilized
- Temp resistant up to +60 °C
- Weather-resistant
- Frost-resistant
- Lawn component 80 - 90 %
- Fixed links in polysurface

APPLICATIONS

- Driveways
- Private parking spaces
- Carports
- Storage areas
- Garden paths
- Strengthening pavements
- Securing slopes
- Protecting stream/river banks

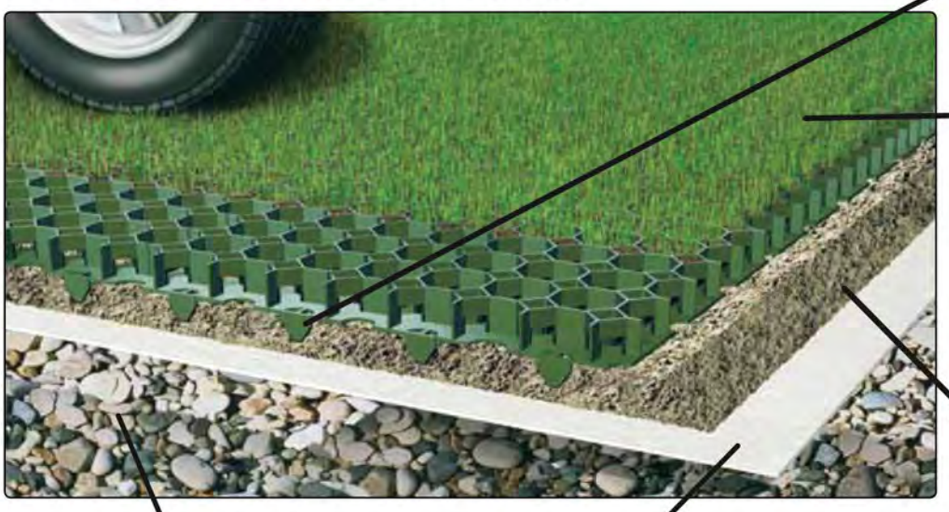
Data Sheets, Installation & Design Guidances
and Case Studies can be downloaded from www.groundtrax.com/downloads

CELLPAVE™ 40

INTERLOCKING CELLULAR PAVING GRID SYSTEM

GROUNDTRAX

RECOMMENDATION FOR LAYING AND GREENING



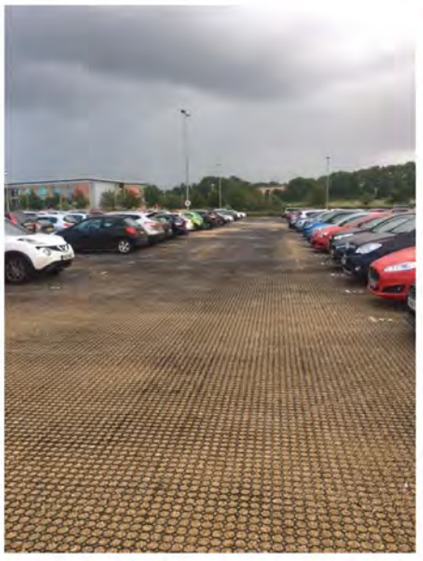
CellPave™ 40 Paving Grid
with 25mm ground spike

Honeycomb Structure
showing soil infill

Bedding Layer
chippings/sand mixture
or crushed stone sand/sand
mixture, water permeable

Sub-Base
gravel or crushed stone mixture
(Type 3 or Reduced Fines Type 1)
Depth varies depending on loadings

Geotextile
filter/seperation layer



Data Sheets, Installation & Design Guidances
and Case Studies can be downloaded from www.groundtrax.com/downloads

GROUNDTRAX

CELLPAVE™ 40

INTERLOCKING CELLULAR PAVING GRID SYSTEM

Backfilled with seed/grass

Backfilled with gravel

White Marker/Delineator

FEATURES AND BENEFITS

- Open cell structure allowing unrestricted healthy grass root growth
- SuDS source control compliant
- Attractive paving solution with a natural grass or permeable retained gravel surface
- 25mm ground spikes resist lateral forces caused by vehicles
- Fast and easy to install
- Manufactured from 100% recycled plastics and are UV Stabilised
- Plastic grass paving grids are chemically inert, non-toxic and rot free
- An eco-friendly, sustainable paving solution for trafficked areas

TECHNICAL SPECIFICATIONS

MATERIAL:	Recycled Polyethylene (HDPE)
DIMENSIONS:	500mm x 500mm wide x 40mm +25mm spikes deep (+/-2%)
WEIGHT:	Each piece is 1.2kg – 4.8kg per m2 (+/-2%)
NOMINAL CELL DIMENSIONS:	60mm Octagonal (+/-2%)
BASE REINFORCEMENT/ANTI SHEAR:	Four 25mm spikes per paver
CONNECTION METHOD:	Edge spikes and loops
CELL WALL THICKNESS:	2.7mm to 3.2mm (+/-2%)
CELL OPENNESS (%)	95% on top and 75% on base
COLOUR:	Black
UV STABILISED:	Yes
LOAD BEARING CAPACITY (FILLED):	150 tonnes per m2 - Tested to DIN EN ISO 604
ENVIRONMENTALLY NEUTRAL:	Tested to ISO 11885 / ISO17294-2A / DIN EN 17933
PRODUCTION CONTROL:	Tested to ISO 11359
TRAFFIC LOADING:	Tested to DIN 1072
PAVER PER M²:	FOUR
PALLET DIMENSIONS:	1000mm x 1000mm x 2430mm / Contains 240 pavers (60m²)
	Total pallet weight 300kg

For more information, contact us today or visit our website:

www.groundtrax.com

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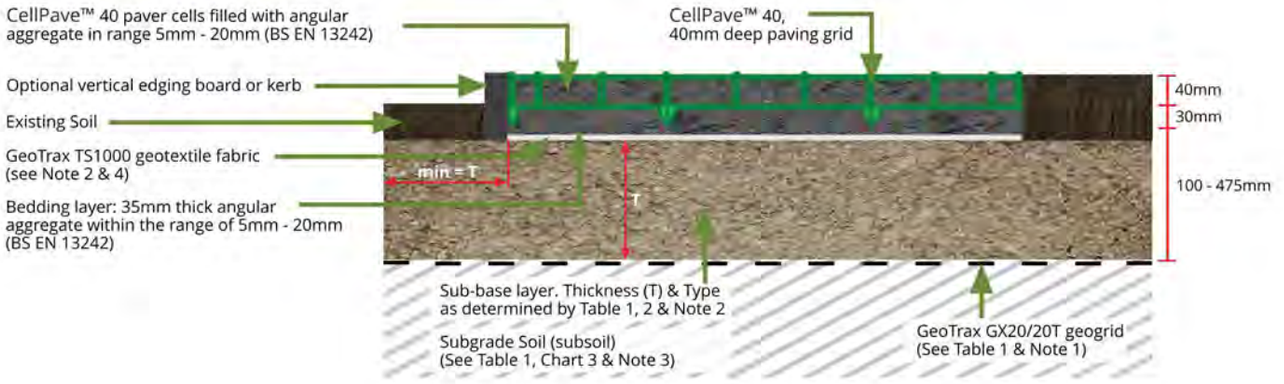
CELLPAVE™ 40
INSTALLATION GUIDE - GRAVEL SURFACES



Installation Method

1. Place paver units with spikes downward onto the prepared well consolidated bedding layer. Edging boards or kerbs can be used where required, according to existing soil conditions.

2. Connect the pavers using the ground spikes and loops, progressing over the area in rows. Use protective gloves to avoid abrasions.

3. Pavers can be cut using a hand or power saw to fit around obstructions and curves. Cut pieces which are less than half the original size should be avoided where possible.

4. Fill the pavers to the top of the cells with the specified angular decorative aggregate. If required, use a light vibrating plate to consolidate the aggregate into the cells. Top up cells with aggregate as necessary. Fully rounded 'pea gravel' is not recommended.

5. If the area is to be used as horse paddock, it is preferable to cover the area with a 50-100mm thick layer of fine sand/mulch.

6. The surface may be trafficked immediately.

Note 1: If the geogrid layer is omitted, then the total sub-base layer thickness (T) must be increased by 50%.

Note 2: A 'DoT Type 1' sub-base may be used, provided that an adequate drainage system is installed (refer to note 4).
Alternatively a porous/open-graded (reduced fines) sub-base layer may be specified, e.g as part of a Sustainable Urban Drainage System (SUDS) application. If a 'reduced fines' sub-base layer is specified, this must be covered with either a geotextile filter membrane and/or a suitable clean gravel blinding layer, to avoid fine particles entering the sub-base layer. Do not use sand for the paver bedding layer.

Note 3: Specific advice on ground conditions, CBR% and construction over ground with a CBR less than 1% is available from Groundtrax Systems Ltd. CBR% = California Bearing Ratio, a measurement of subgrade soil strength.

Note 4: Typical drainage details; 100mm diameter perforated pipe drain laid at minimum gradient 1:100, bedded on gravel in trench backfilled with 'DoT Type A' drainage aggregate, covered or wrapped with GeoTrax TS1000 geotextile fabric and leading to a suitable outfall or soakaway. Drains placed down centre or one edge of access routes up to 5m wide. Wider areas may require additional drains at 5m - 10m centres. Drainage design to be determined by the specifier based on specific conditions on site. Specific advice on Drainage and Sustainable Urban Drainage Systems (SUDS) is available from Groundtrax Systems Ltd.

Note 5: Maximum advised gradient for traffic applications is 12% (1:8) 7°. Pegging may be required. Specific advice for the use of CellPave™ 40 on slopes can be obtained from Groundtrax Systems Ltd.

Note 7: CellPave™ 40 complies with BS8300:2001 - "Design of buildings and their approaches to meet the needs of disabled people" - Code of Practice. (ISBN 0580384381)

Table 1: Typical Sub-base Thickness (T) Requirements - refer to construction profile

Application / Load	CBR (%) strength of subgrade soil *(see Chart 1)*	(T) DoT sub-base thickness (mm) *(see Note 2)*	Geogrid *(see Note 1)*
Fire engine and occasional HGV access	≥ 6	100	GeoTrax GX30/30T
	= 4 < 6	120	GeoTrax GX30/30T
	= 2 < 4	190	GeoTrax GX30/30T
	= 1 < 2	380	GeoTrax GX30/30T
Light vehicle access and overflow car parking	≥ 6	100	GeoTrax GX30/30T
	= 4 < 6	100	GeoTrax GX30/30T
	= 2 < 4	135	GeoTrax GX30/30T
	= 1 < 2	260	GeoTrax GX30/30T

Table 2: Paving Grid Specification

Product	CellPave™ 40
Material	Rigid 100% recycled polyethylene
Colour	Black
Paver Dimensions	500mm x 500mm x 40mm
Paver Size	500mm x 500mm (4 grids per m²)
Nominal Cell Size	60mm Octagonal
Cell Wall Thickness	2.7mm - 3.2mm
Weight	1.2kg/paver - (4.80kg/m²)
Load Bearing Capacity	150 tonnes/m² (Crush resistance)
Central Base Support	25mm long pegs on underside (4 per paver)
Open Cell %	Top 95% / Base 75%
Connection Type	Spike and loop edge connection
Chemical Resistance	Excellent
UV Resistance	High
Toxicity	Non Toxic
Bedding Layer	30mm thick of 5-20mm angular aggregate (BS EN 13242)
Paver fill	To top of pavers using 5-20mm crushed aggregate (BS EN 13242)
Sub-Base Type	DoT Type 3 or a modified porous sub-base *(Table 1 & Note 2)*. DoT Type 1 with drains
Base Reinforcement	E'Grid 30/30 geogrid *(Table 1 & Note 1)* - Specifications available on request.

NOTE:
This field guide is provided as an aid to assessing the mechanical stabilisation requirements in commonly encountered site conditions. Groundtrax Systems Ltd accepts no responsibility for any loss or damgae resulting from the use of this guide.

Chart 1: Field guidance for estimating sub-grade strengths

Consistancy	Indicator			Strength	
	Tactile (feel)	Visual (observation)	Mechanical (test) SPT	CBR %	CU kN/m²
Very Soft	Hand sample squeezes through fingers	Man standing will sink >75mm	<2	<1	<25
Soft	Easily moulded by finger pressure	Man walking sinks 50-70mm	2-4	Around 1	Around 25
Medium	Moulded by moderate finger pressure	Man walking sinks 25mm	4-8	1-2	25-40
Firm	Moulded by strong finger pressure	Unloaded construction vehicle ruts 10-25mm	8-15	2-4	40-75
Stiff	Cannot be moulded but can be indented with thumb	Loaded construction vehicle ruts by 25mm	15-30	4-6	75-150

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SUB-BASE GUIDANCE

SUB-BASE GUIDANCE

The following Groundtrax products will require the installation of a suitable sub-base: **CellPave 40, BodPave 85, CellPave 65 and CellPave HD.**

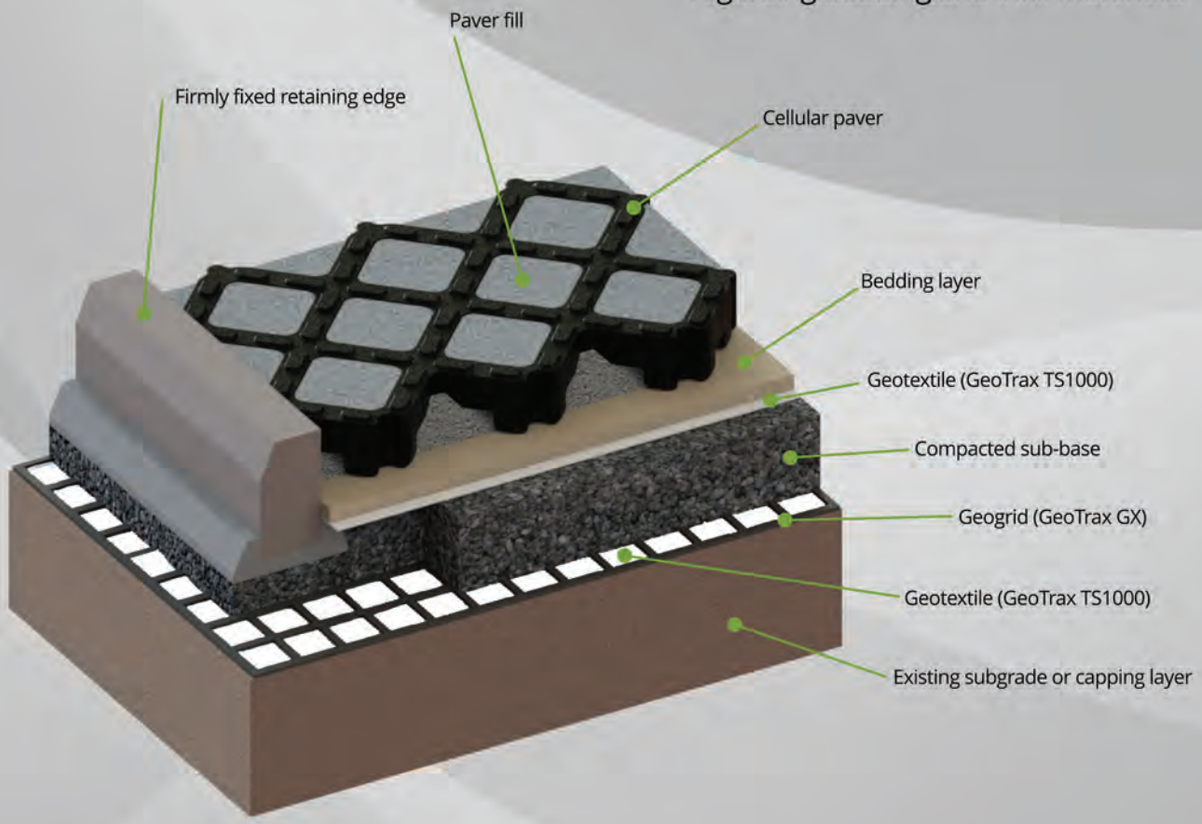
The sub-base layer is the main load bearing element in the system and is designed to spread the load of the cellular paving grids and any traffic thereon to the sub-grade below. A well-constructed sub-base will aid drainage and prevent settlement.

A sub-base works by distributing a point load over a larger area. The interlock between adjacent particles of the sub-base material greatly improves the ability of the ground to carry heavier loads.

A Type 1 sub-base material would normally be unsuitable due to the high fines content leading to minimal porosity and permeability. If this material is to be used, adequate sub-surface drainage must be provided.

Use of a Type 1x, Type 4/40 or Type 3 sub-base is suggested where a SUDS (Sustainable Drainage System) is to be installed. Type 3 is the most commonly used product (see note 2).

If a grassed finish is required to any of the grid systems, please contact us for advice regarding bedding and infill materials.



SUB-BASE GUIDANCE

Build-Up Details

1. After removal of the existing top soil layer and levelling of the surface, a Geotrax TS1000 Geotextile should be rolled out over the existing sub –grade layer. This will provide additional strength to the construction and prevent intermingling of the different layers.

2. A GeoTrax GX geogrid layer should now be installed. The Geogrid layer can help reduce costs by mechanically stabilizing granular materials very efficiently. This product will extend the service life of the system and also helps to control differential settlement. When compacted over the geogrid, the granular particles project through the grids apertures and are mechanically confined. This interlock, combined with the grid's near-uniform 360 degrees stiffness creates an efficient stiff composite layer. If a Geogrid is not used, the total granular sub-base layer thickness must be increased by minimum 50%. The use of the geogrid will therefore greatly reduce the aggregate costs. If construction axle loads are to be greater than 6 tonne (approx. 60kn) the minimum sub-base thickness will be 150mm when used in conjunction with the GeoTrax GX geogrid. The stone size should ideally not exceed 60mm as it will not effectively interlock with the geogrid.

3. Sub-base layer – depth according to the following guidelines

The following table is for general guidance only. Please contact us for scheme specific advice.

APPLICATION/LOAD	CBR % OF SUBGRADE	SUB-BASE THICKNESS	GEOTEXTILE (A)	GEOGRID (B)
LIGHT DUTY (CARS)	OVER 6 %	150 mm	TS1000	
	4 - 6 %	200 mm	TS1000	
CBR 8%	2 - 4 %	230 mm	TS1000	GX20/20
	1 - 2 %	350 mm	TS1000	GX20/20
	BELOW 1 %	CONTACT US		
MEDIUM DUTY (7.5T)	OVER 6 %	150 mm	TS1000	
	4 - 6 %	200 mm	TS1000	GX20/20
CBR 10%	2 - 4 %	300 mm	TS1000	GX30/30
	1 - 2 %	430 mm	TS1000	GX30/30
	BELOW 1 %	CONTACT US		
HEAVY DUTY (HGV)	OVER 6 %	230 mm	TS1000	GX20/20
	4 - 6 %	310 mm	TS1000	GX30/30
CBR 15%	2 - 4 %	470 mm	TS1000	GX30/30
	1 - 2 %	CONTACT US		
	BELOW 1%	CONTACT US		

(A) 2 layers of Geotextile will be required - layer 1 above the sub-grade and layer 2 above the sub-base. Allow an additional 10% total area to allow for overlaps.

(B) Allow an additional 10% total area to allow for overlaps.

SUB-BASE GUIDANCE

Build-Up Details *(cont.)*

4. A second Geotrax TS1000 Geotextile layer should now be installed. This layer adds additional strength to the system and prevents the sub base and bedding layers mixing.

5. Bedding layer. Varies depending on product – CellPave 40 and BodPave 85 will require a 5 to 20mm free draining angular gravel to a depth of around 40mm. This layer should be smooth and level to allow an even surface for laying the pavers onto. A light compaction with a whacker plate is usually sufficient. Do not over compact as these grids both have ground spikes that need to be installed into the bedding layer itself. CellPave 65 and CellPave HD have a flat underside and should be bedded onto a level, well compacted layer of clean sharp sand to a maximum depth of 20mm.

6. The pavers can now be laid onto the prepared bedding layer working outwards laying adjacent grids into their connectors. A solid timber or concrete retaining edge is required for CellPave HD and is also recommended for all other grid products

7. Fill layer of 5mm to 20mm sharp angular gravel. The angular gravels will fill the voids providing a secure, stable finish. A light compaction with a vibratory plate is also recommended to ensure even fill within the cells. It may be necessary to top up to ensure complete fill of the cells. Rounded or single sized gravels should not be used as they will not interlock or carry loadings as well and will also be prone to washing out during heavy rain.

Notes

1. The CBR (California Bearing Ratio,) is a measurement of subgrade soil strength. Please contact us for specific advice on soil CBR% strength, ground conditions, capping-layers & construction over weak ground with a CBR less than 1%. For larger schemes, we are able to offer a design service. We will need to know the existing CBR and the proposed vehicle usage on the area. Our engineers will then specify the appropriate geotextile, geogrid and sub base depths to be installed.

2. Type 3 Sub-base. Pure crushed granite, limestone or clean crushed concrete. A 40mm product that has been screened to create a reduced fines aggregate. This product is fully certified according to the Specification for Highway Works. This is the most widely used sub-base where less fines are required. MOT Type 3 also known as DOT Type 3 after the Department of Transport (DOT) specification for granular sub-base material and is also the most widely used approved sub-base where SUDS (Sustainable Urban Drainage Systems) when constructing permeable surfaces. In order for a product to be classed as 'Type 3' quality it must comply with the Department of Transport Specification for Highway Works, clause 805 (SHW 805).

For more information, contact us
or visit the dedicated website:
www.cellpave.com

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