



**MATURE TREES WITHIN PAVEMENTS
DESIGN RECOMMENDATIONS
Paving/Root-zone Areas
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Introduction

This review and recommendations are for design detail for tree pits associated with existing trees, within paved areas. The brief included “a tree pit design including a root prevention system, to stop new roots developing between the sand bedding material and the new paving slabs”. This review was prepared by P Barton of PBA Consulting.

These recommendations seek to address the issues of design detail for the finish of root zone area around existing trees within paved areas, and the prevention of tree roots penetration of paving substrata. Although this detail can and should be used around new trees, it is outside the brief to provide detailed pit design and recommendations for growing medium, aeration and irrigation.

The interaction of paved surfaces with trees

The interaction of paved surfaces with the dynamic nature of trees leads to conflict and invariably damage to the paved surface. Therefore, it is more practical to design the paved surface to accommodate trees, than to try to manipulate or control growth and development of trees.



Tree root aeration

The requirement for a well aerated growing medium for tree roots cannot be over stressed; it is one of the fundamental physiological issues that affect trees growing within paved areas.

An impervious surface around trees can cause tree root asphyxiation and ultimate death of the tree. The alternative, a large pervious area can be unsightly and may become a hazard; a compromise will be required.

Rooting zone

Mature plane trees can have a buttress root plate in excess of two metres diameter with a rooting zone extending several metres, whereas, the buttress root plate of a semi mature cherry tree could be 350mm with a proportionally smaller rooting zone.

Therefore, it is important to consider the ultimate size of the area required at maturity by different species; however, it is not possible to give one fixed size for all trees. Therefore, general principles should be applied to individual tree species according to their location and requirements.

Root zone area

No tree is static and solutions cannot be permanent. Trees can increase in stem diameter by more than 200mm in 10 years; a London plane tree can grow to over 1.5m diameter in 70 years and allowances will need to be made at the base of the tree for the buttress root incremental increases and rooting zone. Therefore, to accommodate large growing trees like the London plane, a minimum zone of 3.6m x 3.6m may be required with an air permeable surface, not necessarily of open textured gravel. A rooting zone of 2.7m x 2.7m or 1.8m x 1.8m may be possible for smaller trees.



Root incremental increase

Under ground, roots also increase in diameter and with this gradual increase, roots that are close to artefacts (paving slabs, kerbs, tree grills etc.) can, as the diameter increases, lift, move or cause damage. The larger the object affected by root incremental increase, the greater the disproportional movement caused. The movement of small block paving will be proportionately smaller and create less of a hazard should minor movement occur.

Although there is a presumption against block pavers, within the buttress/surface root zone of mature trees, these will provide a safe flexible surface that is easy to maintain. The joints will also aid aeration of the root zone area. To meet the design requirements, standard 900mm x 600 mm pavers could be cut into blocks 90mm x 120mm blocks and would give a uniform finish.

Roots are opportunistic

Roots are normally geotropic (grow downwards) but are opportunistic, taking advantage of any growing medium that contains a combination of air and moisture, for example, sharp sand used for bedding paving slabs. Once rooted into sand these roots will proliferate and increase in diameter and cause movement of pavers. When exposed to the atmosphere, roots normally desiccate particularly when there is low moisture to air ratio.

Design Principles

It is important not to specify hard landscape detail that will be in direct conflict with the dynamic nature of trees. By applying the principles outlined above to the design of paved surfaces around trees, the physiological requirements of trees can be met whilst minimising the trees effects on hard surfaces.

Paving design strategies to integrate with trees

The following strategies should be adopted for construction works around the base of trees in order to minimise conflict with tree growth and development. Design details are shown at Appendix 1.

- 1 Ensure structures including walls, kerbs and paving slabs etc. are not laid directly on any visible significant tree roots. Allow for incremental increase in root diameter within an unimpeded area.
- 2 Do not set kerbs, paving edges etc. on strip foundations that are close to or bed directly on to roots. Use “mini piles” set between roots (hand dug) and have lintels supporting the slabs or kerbs between the “mini piles”, ensure there is sufficient room for incremental increase in root diameter. PBA Consulting proposes that stainless steel lintels are used.
- 3 Where root systems extend under a paved surface, design an “air gap” as an open air space may effectively “air prune” (desiccate) surface roots. These, when coupled with geotropism (downward root growth), roots which would otherwise grow immediately under the paved surfaces, may be deflected away from the air gap and paved surface; additionally, such a technique also increases soil aeration.

A geocomposite drainage/aeration layer will provide an air gap between the paving and the base materials i.e. Type1/subsoil. This product is constructed of two layers of geo-textile material, separated by a plastic cellular structure; the geotextile specified should also inhibit tree root penetration.

The air gap should be extended under the adjacent paving for up to 10 metres as is practical.

- 4 Do not use loose, moist, bedding materials i.e. sharp sand, for bedding paving. Consider using a dense mortar mix that will not be exploited by tree roots. To ensure adequate aeration under the paved surface, use a geo-composite drainage/aeration layer. This should be under the mortar bed to provide an “air gap” between the slabs/blocks and base materials.
- 5 Design root zone area to be extendable in size; for example when growing potentially large trees i.e. London plane, trees allow up to 3.6m x 3.6m area around the tree and infill with small block pavers or standard pavers cut into block 90mm x 120mm blocks to give a uniform finish. As the tree girth and buttress root grows, remove an inner circle of bricks to increase tree base zones. Infill area between the blocks and trees with water-bound path gravel i.e. Breedon gravel or similar to give an air permeable surface around the base of the tree.

Management strategies

As part of the overall management strategy the following issues should be considered to ensure the continuation of the treescape.

- Ensure that the surface of the paving falls away from trees on the carriageway side. This will help to deflect any salt contaminated water away from the base of the tree.
- When planting trees select species appropriate for the area, plant in suitable growing medium of sufficient volume that when the above principles are applied, a minimum open root zone area at maturity will be required.
- As trees are dynamic structures, schedule regular tree inspections every year.

As part of the inspection routine include inspection of, and removing/resetting paving, around the base of trees as appropriate and ensure irrigation /aeration vents are free of debris.

Conclusion

By understanding the physiological requirements of trees within the root zone area and designing in to pave surfaces facilities that meet these requirements, including the choice and use of materials, it should be possible it integrate paved areas with trees.

The recommendations given provide a reasonable compromise between the requirements of trees and standard paving design and its maintenance requirements by providing a safe adaptable surface in which trees are able to grow.

Appendix 1

**Tree Root Zone Area
Detailed Drawings**

