

HISTORY OF THE DIMENSIONS OF ROOT PROTECTION IN BS5837

1980 edition

Clause 6.2

Protective fencing should be erected as nearly as possible to enclose the perimeter of the branch spread of each tree or shrub to be retained. In the case of fastigate trees, it will be beneficial to increase the area of protective fencing to a distance of up to the maximum of two-thirds of the height of the tree.

If reduction or raising of level, in an area up to one-and-a half times the diameter of the canopy of the tree cannot be avoided, an arboriculturist and landscape architect should be consulted for specifications.

Clause 6.4

No oil, tar, bitumen, cement or other material likely to be injurious to a tree should be stacked within 10 m of a bole and no material whatsoever within 5 m of a bole.

Cement mixing should not be carried out within a distance of 10 m of a tree.

Clause 14.4

Table 1. Preferred minimum distance between tree and excavation

| Tree type | Tree height | Min. distance (m) between [outside face of bole of] tree and excavation | |
|-------------------|-------------|--|--------------------|
| | | Depth of dig 300mm | Depth of dig 600mm |
| | Up to 9m | 2.5 | 3 |
| Conifers | 9 to 16m | 5 | 6 |
| | Over 16m | 7 | 7 |
| | Up to 9m | 4 | 5 |
| Broadleaf species | 9 to 16m | 8 | 8 |
| | Over 16m | 12 | 12 |

1991 edition

Table 1 (with additional columns, see notes below)

| Lifestage | Vigour | Stem Diameter (mm) | Use (mm) | RPAr (m) | ratio |
|---|---------------|--------------------|----------|----------|-------|
| Young trees (age less than 1/3 life expectancy) | Normal vigour | < 200 | 200 | 2 | 10 |
| | | 200 to 400 | 300 | 3 | 10 |
| | | > 400 | 400 | 4 | 10 |
| Young trees (age less than 1/3 life expectancy) | Low vigour | < 200 | 200 | 3 | 15 |
| | | 200 to 400 | 300 | 4.5 | 15 |
| | | > 400 | 400 | 6 | 15 |
| Middle age trees (1/3 to 2/3 life expectancy) | Normal vigour | < 250 | 250 | 3 | 12 |
| | | 250 to 500 | 375 | 4.5 | 12 |
| | | > 500 | 500 | 6 | 12 |
| Middle age trees | Low vigour | < 250 | 250 | 5 | 20 |
| | | 250 to 500 | 375 | 7.5 | 20 |
| | | > 500 | 500 | 10 | 20 |
| Mature trees | Normal vigour | < 350 | 350 | 4 | 11.4 |
| | | 350 to 750 | 550 | 6 | 10.9 |
| | | > 750 | 750 | 8 | 10.7 |
| Mature trees and overmature trees | Low vigour | < 350 | 350 | 6 | 17.1 |
| | | 350 to 750 | 550 | 9 | 16.4 |
| | | > 750 | 750 | 12 | 16 |

Notes on this table

Analysis of ratio between stem diameter and RPA radius from BS5837 1991.

The 'use' column is not included in the Standard and is here to allow the multiplier between diameter and root protection area radius to be calculated. It is the diameter assumed to be representative of a range of diameters where this is given.

Always the arithmetic mean of the range boundaries.

Maximum or minimum value has been used for ranges that are 'up to' or 'from'.

The last column is not in the Standard and has been calculated to show the multiplier between diameter and root protection area radius.

Clause 7.5.5.

If it is deemed acceptable for construction works to occur closer than the minimum distance, the distance can be reduced by up to one-third *on one side only*. if distances are reduced in this way, a corresponding increase in distances should be made in other directions.

Clause 7.5.6

As a simple alternative to using Table 1, which requires assessment of the age and vigour of the tree, the fencing may be erected below the outermost limit of the branch spread, or at a distance equal to half the height of the tree, whichever is the further from the tree. This distance will usually be significantly greater than the distances advocated in Table 1.

2005 edition

Clause 5.2.2

The RPA should be calculated using Table 2 as an area equivalent to a circle with a radius 12 times the stem diameter for single stem trees and 10 times basal diameter for trees with more than one stem arising below 1.5 m above ground level.

NOTE The 12× multiplier is based on NJUG 10 [1995] and published work by Matheny and Clark.

5.2.3 The calculated RPA should be capped to 707 m², e.g. which is equivalent to a circle with a radius of 15 m or a square with approximately 26 m sides.

5.2.4

For individual open grown trees only, it may be acceptable to offset the distance by up to 20 % in one direction.

Where any significant part of a tree's crown overhangs the provisional position of tree protection barriers, these parts may sustain damage during the construction period. In such cases, it may be necessary to increase the extent of tree protection barriers to contain and thereby protect the spread of the crown.

2012 edition

For single stem trees, the RPA (see 3.7) should be calculated as an area equivalent to a circle with a radius 12 times the stem diameter. For trees with more than one stem, one of the two calculation methods below should be used.

In all cases, the stem diameter(s) should be measured in accordance with Annex C, and the RPA should be determined from Annex D. The calculated RPA for each tree should be capped to 707 m².

Initial summary and conclusions

The quantification of the root protection area and permitted offsets has become less and less sophisticated, moving from one based on height and tree type, through one based on lifestage, vigour and stem diameter, to a current single 12x stem diameter multiplier.

Permitted offsets have moved from one third to none.

Other considerations and practices

The Ancient Tree Forum advocates (for ancient and veteran trees) the greater of a 15x diameter multiplier or the crown spread + 5 metres.

National Joint Utilities Group still uses 4 x stem girth (equivalent to 12.6 x stem diameter). I.e. BS5837 allows less protection than NJUG.

Much reliance in BS5837 2005 and 2012 has been put on Matheny & Clark 1998 (*Trees and Development: A Technical Guide to Preservation of Trees During Land Development*. Authors, Nelda P. Matheny, James R. Clark.). The authors of that work are almost synonymous with the International Society of Arboriculture. Since that publication the ISA has produced revised guidance. This and American National Standards Institute (2012). *ANSI A300 (part 5)-2012, for Tree Care Operations – Tree, Shrub, and Other Woody Plant Management – Standard Practices (Management of Trees and Shrubs During Site Planning, Site Development, and Construction)* specify protection of between 6 and 18 times stem diameter, depending on species tolerance to root loss, tree age and health.

| Species Tolerance | Tree Age | Multiplier |
|-------------------|-----------------------------------|------------|
| Good | Young (<20% life expectancy) | 6 |
| | Mature (20-80% life expectancy) | 9 |
| | Overmature (>80% life expectancy) | 12 |
| Moderate | Young | 9 |
| | Mature | 12 |
| | Overmature | 15 |
| Poor | Young | 12 |
| | Mature | 15 |
| | Overmature | 18 |

It is apparent that BS5837 has been left with a primitive and simplistic single multiplier whereas the workers that originated that multiplier have moved on to a more sophisticated systems.

The government in Hong Kong uses a hybrid system which operates the following principles.

Tree protection zone (TPZ)

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

Methods generally used include –

- the 'Dripline method', i.e. the tree canopy dripline is used to define the boundary of the TPZ and the entire area within the dripline is considered the TPZ;*
- the 'Tree height method', i.e. the circular area with the radius equal to the height of the tree; and*
- the 'Trunk diameter method', i.e. multiply the trunk diameter at 1.4 m by 6 to 18 to determine the radius of the TPZ, etc. (Fite and Smiley, 2008)*

Under general circumstances in Hong Kong, the 'Dripline method' is adopted. However, for narrow canopied trees, the 'Tree height method' would be appropriate. The 'Trunk diameter' method would be suitable for trees which are leaning or of irregular conformation.

A bigger TPZ is usually preferred. The tolerance level of a tree may depend on tree species, age/size, health/vigor, site conditions etc. and further deliberation on factors on a case by case basis would be necessary.

JM 3/3/24

Footnote

NJUG v BS5837 root protection

The useful comparator is the root protection radius. Call this RPR.

5837 starts with diameter d.

$$RPA = (12d)^2 \times \pi$$

$$RPR = 12d$$

NJUG starts with circumference C

$$RPR = 4C$$

$$\text{But } C = \pi d$$

$$\text{So, } RPR = 4\pi d = 12.56$$

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