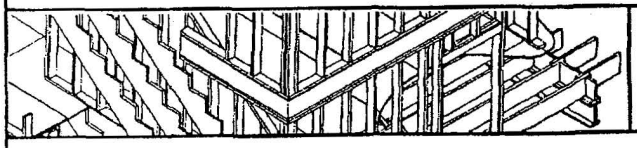


RAMSEY/SLEEPER

ARCHITECTURAL GRAPHIC STANDARDS

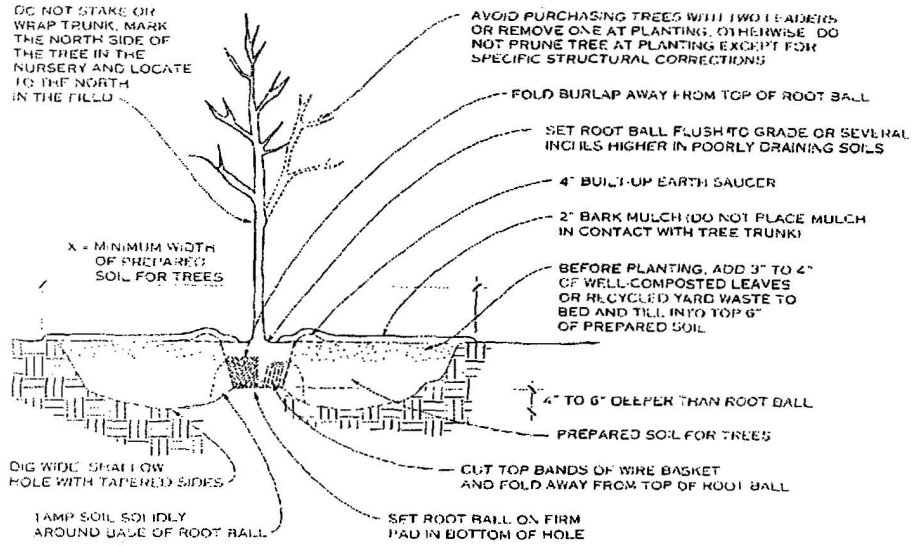


TENTH EDITION

JOHN RAY HOKE, JR., FAIA
EDITOR IN CHIEF

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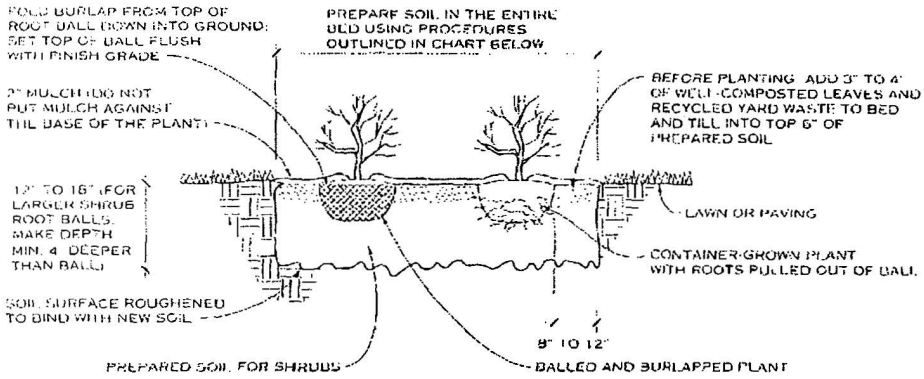
BZA
Case No. 16836
Exhibit No. 89
Board of Zoning Adjustment
District of Columbia
CASE NO.16836
EXHIBIT NO.89



NOTES

1. For container-grown trees, use fingers or small hand tools to pull the roots out of the outer layer of potting soil; then cut or pull apart any roots circling the perimeter of the container.
2. Incorporate commercially prepared mycorrhiza spores in the soil immediately around the root ball at rates specified by the manufacturer.
3. During the design phase, confirm that water drains out of the soil; design alternative drainage systems as required.
4. Thoroughly soak the tree root ball and adjacent prepared soil several times during the first month after planting and regularly throughout the following two summers.
5. The planting process is similar for deciduous and evergreen trees.

TREE PLANTING DETAIL (BALLED AND BURLAPPED PLANTS)



NOTES

1. For container-grown shrubs, use fingers or small hand tools to pull the roots out of the outer layer of potting soil; then cut or pull apart any roots that circle the perimeter of the container.
2. Incorporate commercially prepared mycorrhiza spores in the soil immediately around the root ball at rates specified by the manufacturer.
3. Confirm that water drains out of the soil during the design phase; design alternative drainage systems as required.

SHRUB PLANTING DETAILS

SOIL IMPROVEMENT

The quality of soil available for planting varies widely from site to site, especially after construction activity has occurred. The nature of construction results in compaction, filling, contamination, and grading of the original soil on a site, rapidly making it useless for plants. Previous human activity at a site can also affect the ability of the soil to support plants.

During the design phase, assumptions must be made regarding the probable condition of the soil after construction is complete. The health of existing or remaining soil determines what types of soil preparation will be required and the volume of soil to be prepared. Conditions will vary from location to location within a project, and details must be condition-specific. For large projects or extreme conditions, it is useful to consult an expert experienced in modifying planting soils in urban sites.

NOTES

1. If site or design constraints prohibit use of the dimensions shown on this page, follow the guidelines for planting in urban areas.
2. Wherever possible, the soil improvement area should be connected from tree to tree.
3. Always test soil for pH and nutrient levels and adjust these as required.
4. Loosen soil with a backhoe or other large construction equipment when possible. Tilling at produces large, coarse chunks of soil is preferable to tilling that results in fine grains uniform in texture.
5. The bottom of planting soil excavation should be rough to avoid mixing of soil layers as new soil is added. It is preferable to till the first 1 ft (2 to 3 in. of planting soil into the subsoil.

STANDARD ROOT BALL SIZES FOR NURSERY-GROWN SHADE TREES

CALIPER* (IN.)	HEIGHT RANGE (FT-IN.)	MAX. HEIGHT (FT)	MIN. BALL DIA. (IN.)	MIN. BALL DEPTH (IN.)
½	5-6	8	12	9
¾	6-8	10	14	10½
1	8-10	11	16	12
1-¼	8-10	12	18	13½
1-½	10-12	14	20	13½
1-¾	10-12	14	22	14½
2	12-14	16	24	16
2-½	12-14	16	28	18½
3	14-16	18	32	19½
3-½	14-16	18	36	23
4	16-18	22	42	25
5	18-20	26	54	32½

*Up to and including the 4-in. caliper size, the caliper measurement indicates the diameter of the trunk 6 in. above ground level. For larger sizes, the caliper measurement is taken 12 in. above ground level.

NOTES

1. See American Standard for Nursery Stock, ANSI Z60.1, for complete list of nursery standards for other types and sizes of trees and shrubs.
2. See International Society of Arboriculture's "Principles and Practices of Planting Trees and Shrubs," 1997.

GENERAL RANGE OF SOIL MODIFICATIONS AND VOLUMES FOR VARIOUS SOIL CONDITIONS

POSTCONSTRUCTION SOIL CONDITION	MIN. WIDTH PREPARED SOIL FOR TREES (X)	TYPE OF PREPARATION
Good soil (not previously graded or compacted, topsoil layer intact)	6 ft or twice the width of the root ball, whichever is greater	Loosen the existing soils to the widths and depths shown in details above
Compacted soil (not previously graded, topsoil layer disturbed but not eliminated)	15 ft	Loosen the existing soils to the widths and depths shown in details above; add composted organic matter to bring the organic content up to 5% dry weight.
Graded subsoils and clean fills with clay content between 5 and 35%	20 ft	Minimum treatment: loosen existing soil to widths and depths shown, add composted organic matter to bring organic content up to 5% dry weight. Optimum treatment: remove top 8-10 in. of the existing material, loosen existing soils to the widths and depths shown, add 8-10 in. of loam topsoil.
Poor quality fills, heavy clay soils, soils contaminated with rubble or toxic material	20 ft	Remove existing soils to the widths and depths shown, replace with loam topsoil.

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American Nursery & Landscape Association (formerly AANI); Washington, D.C.

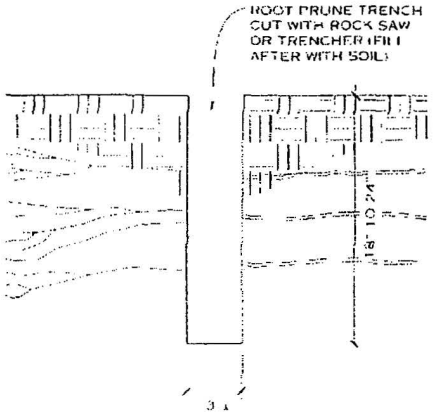
CONSTRUCTION AROUND EXISTING TREES

Great care should be taken not to compact, cut, or fill the earth within the crown area of existing trees. Most tree roots are located in the top 6 to 18 in. of the soil and often spread considerably farther than the drip line of the tree. Compaction can cause severe root damage and reduce the movement of water and air through the soil. To avoid compacting the earth, do not operate equipment or store materials within the crown spread.

Before construction begins, inject the soil within the crown area of nearby mature trees with commercially prepared kelp based fertilizer and mycorrhiza fungus developed to invigorate tree roots. Prune tree roots at the edge of the root save area, as roots pulled during grading can snap or split well into the root save area. Rot and disease that enters dying roots in compacted or filled areas can move into the tree if root pruning has not been carried out. Install tree protection fencing and silt protection at the limits of construction activity near trees.

During construction, apply additional water in the canopy area to compensate for any root loss beyond the crown spread. Have all mature trees inspected by a certified arborist before construction begins to identify any special problems. Remove all deadwood and treat all trees for existing insect and disease problems. When possible, begin fertilization and problem treatments at least one full growing season before construction.

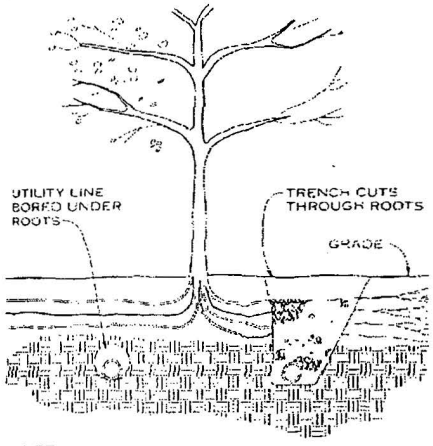
Removal of significant portions of the crown will affect the health of a tree by reducing its ability to photosynthesize in proportion to the mass of its trunk. Younger, healthier trees withstand construction impacts better than older trees.



NOTE

A root prune trench severs roots with a clean cut, protecting remaining roots from cracking, rot, and disease.

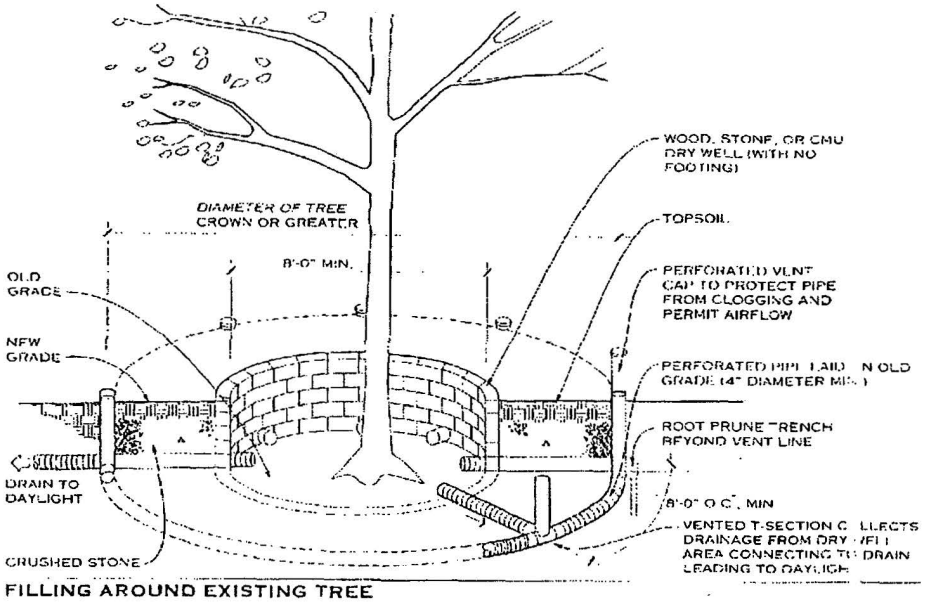
ROOT PRUNE TRENCH



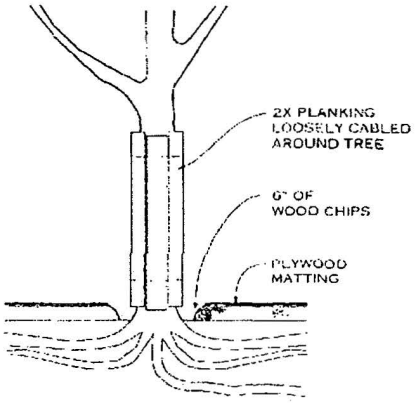
NOTE

Fewer roots are severed by tunneling under a tree than by digging a trench beside it.

UNDERGROUND UTILITY LINE NEAR EXISTING TREES

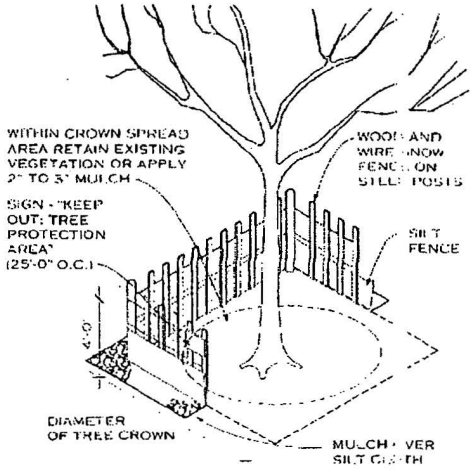


FILLING AROUND EXISTING TREE



NOTE

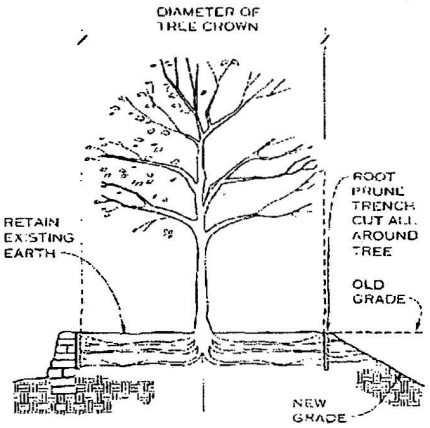
If construction operations must take place within the crown spread area, install 6 in. of wood chips on top of the soil to protect it. Use plywood matting over mulch in areas where equipment must operate. Protect the trunk of the tree with planking loosely cabled around the tree to reduce scarring by equipment. Remove planking, matting, and mulch as soon as operations are finished.



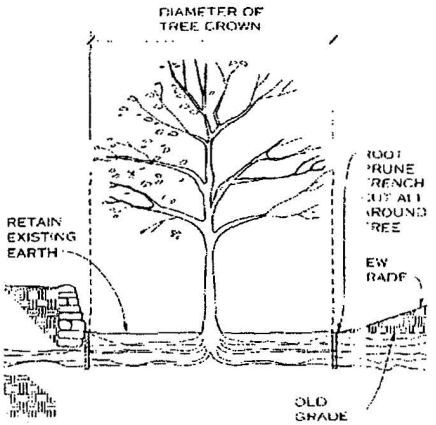
NOTE

A barrier such as that illustrated can keep construction equipment and personnel from compacting the soil around tree roots.

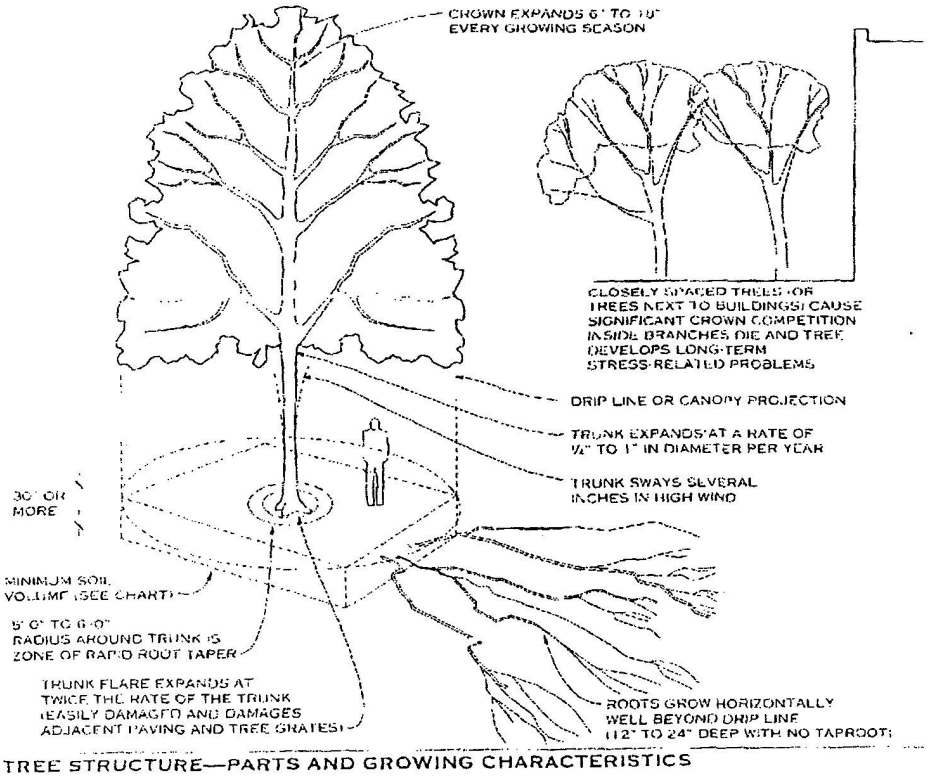
TREE AND ROOT PROTECTION



CUTTING GRADE AROUND EXISTING TREE



FILLING GRADE AROUND EXISTING TREE



TREE STRUCTURE—PARTS AND GROWING CHARACTERISTICS

GENERAL

Areas of dense urban development leave *little room for tree roots* to develop. Large areas of pavement, competition with foundations and utilities for space below ground, and extensive soil compaction and disruption limit the amount of soil available for trees. When the area of ground around the tree open to the rain and sun is less than *400 to 500 sq ft per tree*, the following design guidelines should be followed to encourage the growth of large healthy trees.

Five major parts of the tree structure must be accommodated in the design process.

CROWN GROWTH: The tree crown expands every growing season at a rate of 6 to 10 in. per year. Once the crown reaches a competing object such as a building or another tree canopy, the canopy growth in that area slows and then stops. Eventually the branches on that side of the tree die. As the canopy expansion potential is reduced, the overall growth rate and tree health are also reduced.

TRUNK GROWTH: The tree trunk expands about ¼ to 1 in. per year. As the tree increases in size, the lower branches die and the trunk lengthens. Tree trunks move considerably in the wind, especially during the early years of development, and are damaged by close objects.

TRUNK FLARE: At the point where the trunk leaves the ground, most tree species develop a pronounced swelling or flare as the tree matures. This flare grows at more than twice the rate of the main trunk diameter and helps the tree remain structurally stable. Any hard object placed in this area, such as a tree grate or confining pavement, will either damage the tree or be moved by the tremendous force of this growth.

ZONE OF RAPID ROOT TAPER: Tree roots begin to form in the trunk flare and divide several times in the immediate area around the trunk. In this area, about 5 to 6 ft away from the trunk, the roots rapidly taper from about 6 in. in diameter to about 2 in. Most damage to adjacent paving occurs in this area immediately around the tree. Keeping the zone of rapid taper free of obstructions is important to long-term tree health. Once a tree is established, the zone of rapid taper is generally less susceptible to compaction damage than the rest of the root zone.

ROOT ZONE: Tree roots grow radially and horizontally from the trunk and occupy only the upper layers (12 to 24 in.) of the soil. Trees in all but the most well-drained soils do not have taproots. A relationship exists between the amount of tree canopy and the volume of root supporting soil required (see the accompanying chart). This relationship is the most critical factor in determining long-term tree health. Root supporting soil is generally defined as soil with adequate drainage, low compaction, and sufficient organic and nutrient components to support the tree. The root zone must be protected from compaction both during and after construction. Root zones that are connected from tree to tree generally produce healthier trees than isolated root zones.

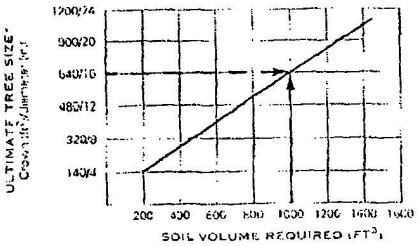
SOIL MODIFICATIONS

Thoroughly till organic matter into the top 6 to 12 in. of most planting soils to improve the soil's ability to retain water and nutrients. (Do not add organic matter to soil more than 12 in. deep.) Use composted bark, *recycled yard waste*, peat moss, or municipal processed sewage sludge. All products should be composted to a dark color and be free of pieces with *identifiable* leaf or wood structure. Recycled material should be tested for pH and certified free of toxic material by the supplier. Avoid material with a pH higher than 7.5.

Modify heavy clay or silt soils (more than 40% clay or silt) by adding composted pine bark (up to 30% by volume) and/or gypsum. Coarse sand may be used if enough is added to bring the sand content to more than 80% of the total mix. Improve drainage in heavy soils by planting on raised mounds or beds and including subsurface drainage lines.

Modify extremely sandy soils (more than 85% sand) by adding organic matter and/or dry, shredded clay loam up to 30% of the total mix.

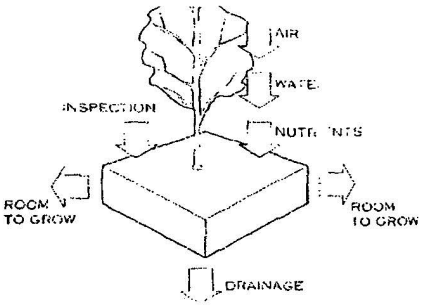
SOIL VOLUME FOR TREES



*The ultimate tree size is defined by the projected size of the crown and the diameter of the tree at breast height.

NOTE

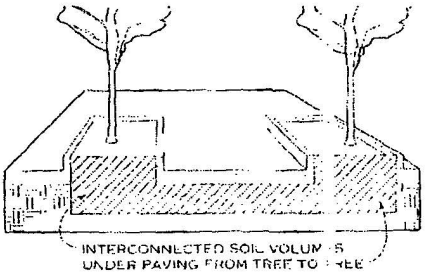
For example, a 16 in. diameter tree requires 1000 cu ft of soil.



NOTE

Soil volume provided for trees in urban areas must be sufficient for long-term maintenance.

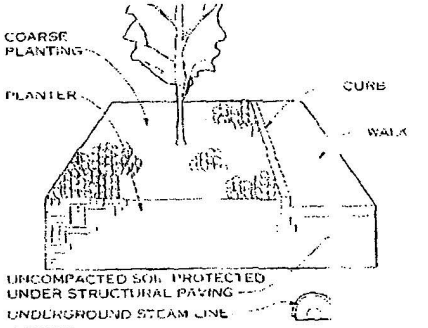
SOIL VOLUME—REQUIREMENTS FOR TREES



NOTE

The interconnection of soil volumes from tree to tree has been *observed* to improve the health and vigor of trees.

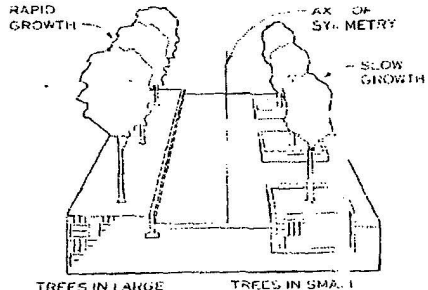
SOIL VOLUME—INTERCONNECTION



NOTES

1. Coarse plantings keep pedestrians out of planters.
2. Curbs protect planters from pedestrians and *leaving salts.*
3. *Underground* steam lines must be insulated or vented to protect planter soil.

SOIL PROTECTION FROM COMPACTION AND DEGRADATION



NOTE

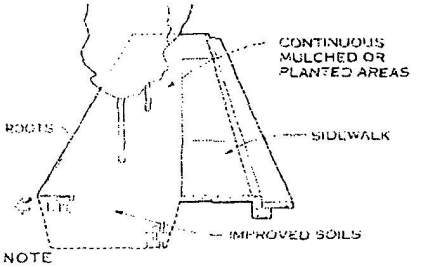
If visually symmetrical tree planting is required, symmetrical soil volumes are also required to produce trees of similar crown size.

VISUALLY SYMMETRICAL TREES

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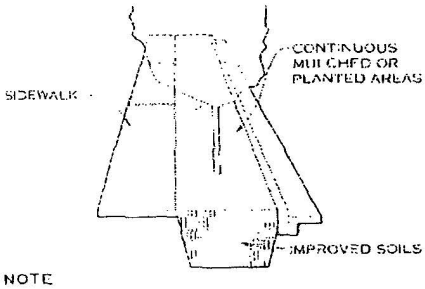
GENERAL

Traditional urban designs in which trees are regularly spaced in small openings within paved areas generally result in poor tree performance. This is because such designs generally do not provide adequate soil for root growth and ignore the fact that trees must significantly increase trunk size every year. As well, competition for space, both at ground level and below, is intense in urban areas.



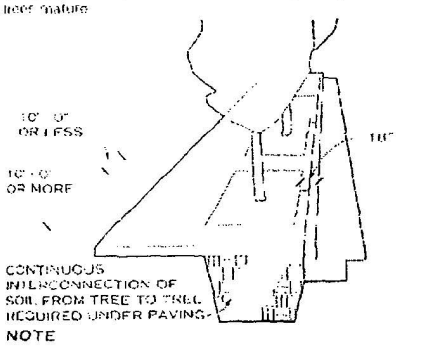
NOTE

Best design option: Planting trees between sidewalks and buildings creates the fewest conflicts between roots and paving by permitting rooting activity on adjacent property.



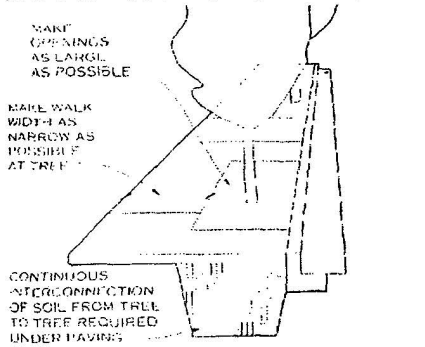
NOTE

Acceptable design option: Planting between curbs and sidewalks in a continuous unpaved planting bed provides good soil levels for trees but contributes to root/paving conflicts as trees mature.



NOTE

Difficult design option: In highly developed areas with parking adjacent to the curb, planting in long narrow tree openings with an 18-in. wide walk along the curb accommodates pedestrians exiting cars. Root/paving conflicts are probable.

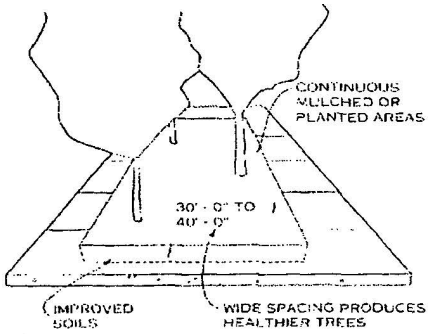


NOTE

Most difficult (and most expensive) design option: Tree openings are undersized for future trunk/root development. Severe root/paving conflicts are very likely.

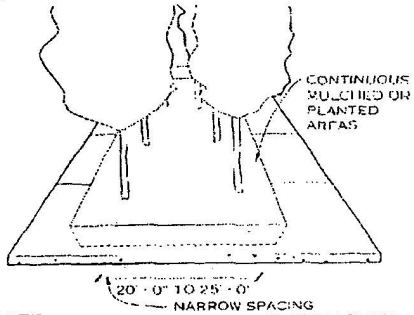
SIDEWALK PLANTING OPTIONS

Although it is possible to design unconnected soil volumes for trees under pavement, this is very expensive and the soil is never as efficient as that in open planting beds. Increasing trunk size can only be accommodated by using flexible materials that can change configuration over time. Urban designs that have flexible relationships between trees, paving, and planting beds and large areas of open planting soil offer the best opportunity for long-term tree health and lower maintenance costs.



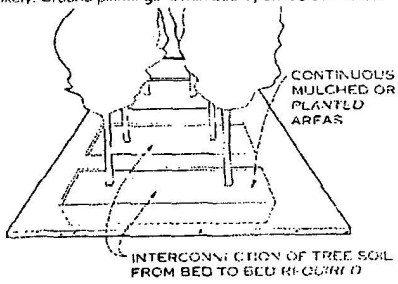
NOTE

Best design option. Separate planting and walking areas. Avoid small disconnected soil volumes to minimize root/paving conflicts.



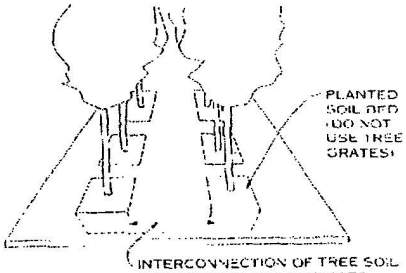
NOTE

Acceptable design option. Each tree has a smaller canopy with less yearly growth. More disease and insect problems are likely. Ground plantings eliminated by shade over time.



NOTE

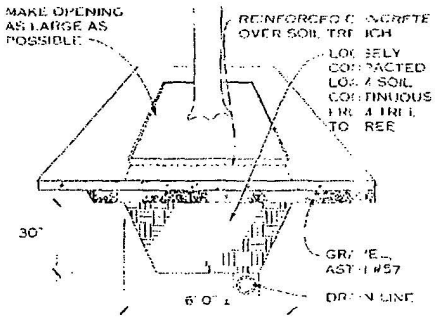
Difficult design option. Shading, slow tree growth, and poor health are problems. Root/paving conflicts are likely.



NOTE

Most difficult (and most expensive) design option: Slow tree growth and severe root/paving conflicts are to be expected.

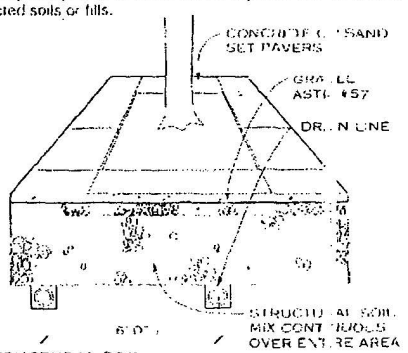
PLAZA TREE PLANTING OPTIONS



CONTINUOUS SOIL TRENCH

NOTE

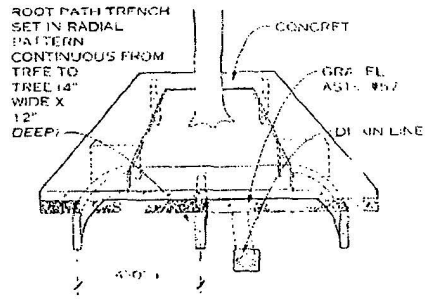
A continuous soil trench provides very good soil but in limited quantity. Use in areas where adjacent backfill is compacted soils or fills.



STRUCTURAL SOIL

NOTE

Structural planting soils replace subgrade materials with a fill that can be compacted to meet normal engineering compaction requirements and still support root growth below the pavement. The principle is that when the gravel is compacted, the soil is not because the amount of soil in the mix is insufficient to fill all the voids. Hydrogel, a cross-linked potassium copolymer, is used to help bind the mixture during the mixing process. The soil mix includes ASTM D #4 gravel (80 lb calculated dry weight), shredded clay loam (15.18 lb), hydrogel (0.03 lb), and water ±10 (including the water calculated in the gravel and the soil). For further information, contact the Urban Horticulture Institute at Cornell University (Ithaca, NY).



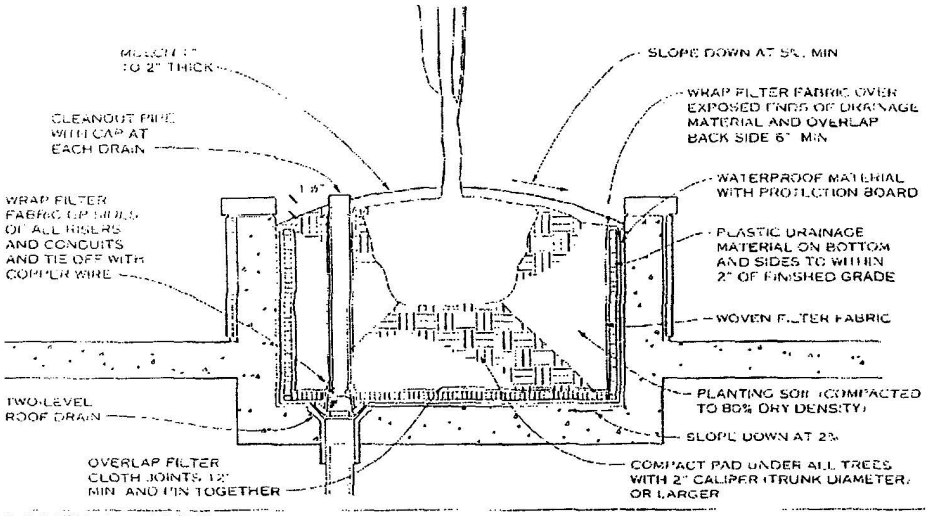
ROOT PATH TRENCH

NOTES

1. In urban areas where the pavement subgrade is compacted soil that is free from rubble, toxic, or poorly drained fills, a system of root paths can be installed to guide roots under the pavement, where they have room to grow. These roots grow deeper in the soil, causing fewer root/paving conflicts than roots left to exploit the normal minor weaknesses in paving and subgrades.
2. A root path trench is made by installing a length of strip drain material (a 12-in. wide x 1-in. thick plastic drain core wrapped in filter fabric) in a narrow trench and backfilling with loam topsoil. This allows air and water to flow more freely into the soil under the pavement. Install geotextile fabric and the gravel base material and then pave.
3. Root paths cannot replace larger soil trenches or structural planting soil in areas in which existing soil conditions are extremely poor for root exploration.

TREE SOIL INTERCONNECTION OPTIONS UNDER PAVING

James Urban, ASLA, James Urban Landscape Architecture; Annapolis, Maryland



ROOFTOP PLANTER

SELECTING PLANTS FOR ROOFTOP PLANTING

When choosing plants for a rooftop setting, consider the factors outlined below:

WIND TOLERANCE: Higher elevations and exposure to wind can cause defoliation and increase the transpiration rate of plants. High parapet walls with louvers can reduce wind velocity and provide shelter for plants.

HIGH EVAPORATION RATE: The drying effects of wind and sun on the soil in a planter reduce soil moisture rapidly. Irrigation, mulches, and moisture-holding soil additives (diatomaceous earth or organic matter) help reduce this moisture loss.

RAPID SOIL TEMPERATURE FLUCTUATION: The variation in conduction capacity of planter materials results in a broad range of soil temperatures in planters of different materials. Cold or heat can cause severe root damage in certain plant species. Proper drainage helps alleviate this condition.

TOPSOIL: Improve topsoil in planters to provide optimum growing conditions for the plants selected. A general formula calls for adding fertilizer (determined by soil testing) and one part peat moss to five parts sandy loam topsoil. More specific requirements for certain varieties of plants or grasses should be considered.

ROOT CAPACITY: Choose plant species carefully, considering their adaptation to the size of the plant bed. If species with shallow, fibrous roots are used instead of species with a coarse root system, consult with a nursery advisor. Consider the ultimate maturity of the plant species when sizing a planter.

PLANTING DETAILS

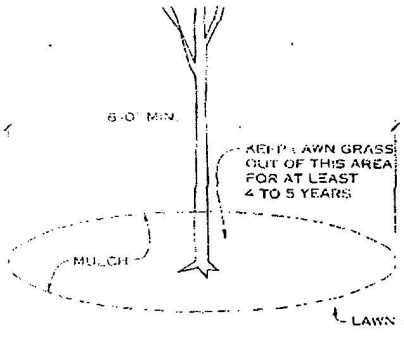
SOIL DEPTH: Minimum soil depth in a planter varies with the plant type: for large trees, the soil should be 36 in. deep or 6 in. deeper than the root ball; for small trees, 30 in. deep; for shrubs, 24 in. deep; and for lawns, 12 in. deep (10 in. if irrigated).

SOIL VOLUME: To determine sufficient soil volume, see chart on Soil Volumes for Trees (on another AGS page in this section).

SOIL WEIGHT: The saturated weight of normal soil mix ranges from 100 to 120 pcf, depending on soil type and compaction rate. Soils can be made lighter by adding expanded shale or perlite. Soils lighter than 80 pcf cannot provide structure adequate to support trees.

DRAINAGE FABRIC: Plastic drainage material should be a minimum of ½" thick. Most drainage material comes with a filter fabric attached, but the overlap joints provided are not wide enough for the unconsolidated soils found in planters. A second layer of woven filter fabric, delivered in rolls greater than 10 ft in width, should be installed. Tuck the fabric over the exposed top of the drainage material to keep soil out of the drainage layer.

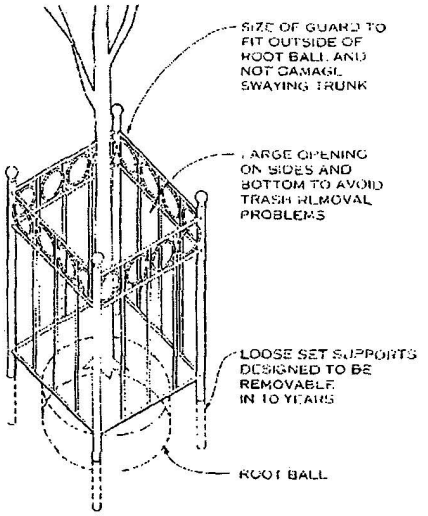
INSULATION: Most planters do not require insulation; however, in colder climates planters with small soil volumes located over heated structures may require insulation. Consult local sources for a list of cold-hardy plants.



NOTE

Young trees planted in lawn areas face substantial competition from the roots of grasses.

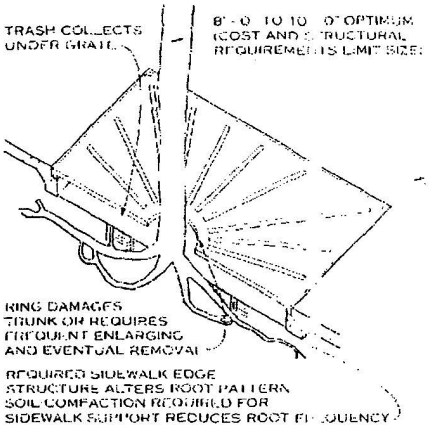
TREES PLANTED IN LAWNS



NOTE

Tree guards can protect young trees from trunk damage caused by bicycles. If made too small, however (less than 30 in. in diameter), they can damage the tree as it grows and are difficult to remove. The high cost and potential harm to trees outweigh the minor protection tree guards afford a trunk. They should only be used in areas with particularly high traffic.

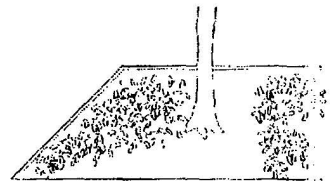
TREE GUARDS



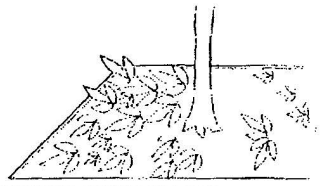
NOTE

Tree grates separate the base of a tree but provide no significant benefit. Many aspects of tree grates can damage a tree or reduce its potential for growth.

TREE GRATES



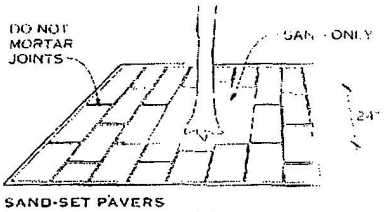
BARK MULCH



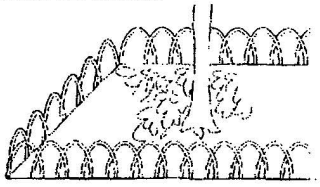
GROUND COVER PLANTS



STONE DUST OR GRAVEL



SAND-SET PAVERS



LOW FENCE AND GROUND COVER

NOTE

Alternatives to tree grates (and guards) include softer, organic coverings that suit the purpose better, are less expensive, and require less maintenance over the life of the tree.

TREE BASE PROTECTION

James Urban, ASLA, James Urban Landscape Architecture; Annapolis, Maryland