— *LANDSCAPING: TREE SELECTION* —

August 20, 2021

Planning Board
8 Newmarket Road
Durham, NH 03824

Re: Mill Plaza Redevelopment. 7 Mill Road. Continued review of application for site plan and conditional use for mixed-use redevelopment project, drive-through facility for bank, and activity within the wetland and shoreland overlay districts. Colonial Durham Associates, property owner….Central Business District. Map 5, Lot 1-1.

Dear Planning Board members:

Colonial Durham Associates has submitted two sheets for a revised plan. Neither is a landscaping plan, which may be forthcoming. But before the Board gives the applicant a go-ahead to flesh out a full set of revised plans, please consider the following.

Fundamentally, I think we share the same goal for landscaping at the Plaza: Vegetation that provides shade, is low maintenance, attractive, and appropriate for the site's harsh conditions so that it survives to and beyond maturity rather than for only for show when the doors open.

The accompanying document from Virginia Tech, "Trees for Parking Lots and Paved Areas," includes a table titled "Trees unsuitable for restrictive paved areas due to large surface roots." That table includes trees (#) proposed on the March 10, 2021 landscaping plan: red maple (8), river birch (3), and hackberry (5).

In addition, Appendix B of the Site Plan Regulations, as amended April 24, 2019, lists vegetative species that are either recommended or are invasive species to be avoided. It is worth taking a look at relative to the species proposed for the Mill Plaza, specifically for the "cultural notes," aka, horticultural or growing notes.

For example, Black Gum (*nyssa sylvatica*) "requires moisture, [is] intolerant to pollution, soil compaction; requires careful consideration for special use." So why are seven of these proposed for a site that is largely an open parking lot, aka, a heat island?

No, Mill Plaza is not legally constrained by Appendix B. However, as I have stated regarding other matters, Conditional Use allows the Board reasonable discretion, and where the Board revised site plan regulations that reflect more recent relevant knowledge and that were supported by the community, shouldn't you take the guidance of Appendix B under advisement?

But it's not just about Appendix B or Virginia Tech's document.

More to the point: It is worth noting that landscape architects generally are not arborists nor horticulturalists. As with any professional, each will have greater or lesser strengths and differ in areas of specialization. Where the choice of tree species is critical, as it is in this case, I think the community might want to feel comfortable that the Planning Board has gone beyond simply accepting the applicant's word.

Please confirm that the applicant's landscape architect has reviewed our site plan regulations for landscaping and screening and that, more important, the architect can demonstrate that the species selections are appropriate both for the site in general and for specific locations on the site. I can provide evidence to the contrary.

Resources include:

- The Missouri Botanical Garden's "Plant Finder" <https://www.missouribotanicalgarden.org/plantfinder/plantfindersearch.aspx>
- "Recommended Urban Trees: Site Assessment and Tree Selection for Stress Tolerance" from Cornell University's Urban Horticulture Institute (links from <http://www.hort.cornell.edu/uhi/outreach/recurbtree/index.html>

I would be happy to provide documentation for several of the proposed species, both appropriate and less appropriate choices, from the above resources.

Sincerely yours,

— Robin

Virginia Cooperative Extension

PUBLICATION 430-028

Trees for Parking Lots and Paved Areas

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An urban phenomenon

Parking lots and paved areas are essential urban features that tend to be unsightly in their basic form. Municipal ordinances often mandate specific amounts of parking for different types of commercial or residential land use, as well as landscaping for these parking areas. Landscaping in and around parking lots and pavement improves appearance, prevents soil erosion, and reduces carbon dioxide through photosynthesis. Planted areas also reduce storm water drainage problems, reduce the detrimental effects of wind and noise, and enhance human comfort by providing heat-reducing shade.

Paved areas pose challenges

Many of the urban challenges that trees face begin with the construction process. At the beginning of parking lot construction, topsoil is generally removed. The subgrade is then compacted, followed by layers of crush and run stone, and asphalt or concrete that are spread and also compacted. If municipal compaction specifications are adhered to, the resulting soil mix under the pavement is generally impenetrable to roots due to mechanical impediment. It also limits root growth due to low available oxygen.

Trees planted near pavement often suffer due to root damage and soil volume restriction. The lateral growth of shallow tree roots causes sidewalks to crack and heave, creating "lips" or "stub-toe" spots because of uneven displacement of adjoining sections of concrete. This root vs. pavement conflict is one of the most pervasive problems in urban forestry. Removal and/or replacement of trees and repair of paved surfaces can strain limited municipal funds. In addition, city governments may be found liable in damage suits where injuries occur as a result of pavement hazards.

Selecting appropriate trees for parking lots and other paved areas is challenging. Paved surfaces are engineered to quickly shed water, often in directions that either deprive trees of adequate soil moisture or leave their roots submerged in excess water. Heat from parking lots and other pavement is exacerbated by the solar heat sink of the pavement, with adjacent buildings and cars adding to the stress. Limited soil volumes confine roots, restricting root growth, reducing anchorage, and often supplying inadequate moisture and nutrients. The stress of compaction and low soil fertility, coupled with other physical, environmental and human forces acting against trees makes parking lots and paved areas unfriendly to trees. These factors combined make 7 - 10 years the average life expectancy of most urban trees.

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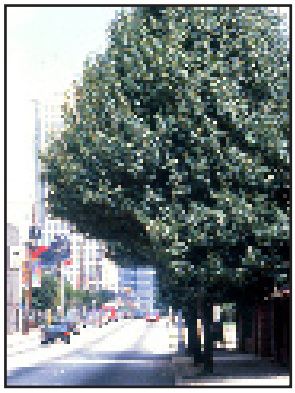
Selection and planting recommendations

Use appropriate tree species. Avoid trees with large surface roots that may damage pavement, and trees with dense canopies that block light penetration to the pavement, preventing rapid evaporation of precipitation. Also avoid trees that can litter the pavement with fruit, branches, and large leaves.

Where trees will be installed into parking lot "islands" which create a pseudo-container for roots, design these islands with as much soil volume as possible. Ideally, the roots should be able to grow at least to the drip line or crown edge of the tree at maturity. A soil volume of 2 to 3 cubic feet per 1 square foot of crown spread is recommended. Where soil volumes are restrictive, select smaller tree species or cultivars, or species that are especially heat and drought tolerant.

Plan for the mature size of the tree above ground. Be sure tree heights will not interfere with overhead utility lines or building overhangs. Be sure that tree spreads will not interfere with pedestrians or vehicles that must pass beneath the trees. In narrow areas, upright or columnar cultivars of trees may be needed.



Follow good planting practices (See VCE Publication 430-295 - Tree and Shrub Planting Guidelines).

Maintain 2 - 3 inches of mulch within the drip line of the tree, replenishing as needed. Keep the mulch from contacting the tree trunk, and minimize the number of competing plants within this mulched area.

Whenever possible, design permanent drip or pop-up irrigation systems. Restricted root systems, reflected heat, and dry summers create extreme drought stress for trees in parking lots and other paved areas. Avoid cutting tree roots when irrigation is installed after trees are established. Be sure the amount of irrigation is appropriate for the tree species because irrigation quantities needed for turf maintenance are generally excessive for trees.

Fertilize if tree growth (pale and small leaves or stunted twigs) and/or soil or plant tissue analyses indicate nutrient deficiencies. Application of a controlled release nitrogen fertilizer may be needed every year or two if no turf fertilizer is applied and if soil volumes for root growth are restrictive.

Select salt tolerant tree species for parking lots and paved areas where deicing salts may accumulate or drain over tree roots.

New strategies for paved areas

Research on tree planting practices has yielded new information on reducing stress to urban trees. Some of these practices include the use of root barriers, engineered soils, updated pavement repair methods or replacements, and different methods of tree pit construction.

Root barriers can be used to divert tree roots from sidewalks and other paved areas. Barriers are made of either rigid plastic or herbicide-treated polypropylene fabric. The barriers are placed in vertical soil trenches between the tree and the pavement to divert lateral roots downward. If soil conditions are favorable, most roots will continue growing laterally at a lower depth along the barrier, although some may resurface after they grow under the barrier.

Sidewalks and pavement need a firm foundation (compact soil) to insure structural integrity. Conversely, compacted soil is a major cause of surface tree root development. To satisfy the needs of both trees and pavement, engineered soils are being used in tree pits. In one engi-

neered soil, gravel and soil are mixed so that weight-bearing loads are transferred from stone to stone in the gravel while leaving the soil between the stones essentially unaffected by compaction. The overall effect of this engineered soil is to create a larger rooting volume with increased porosity, nutrient holding capacity and drainage – a healthier environment for tree root growth.

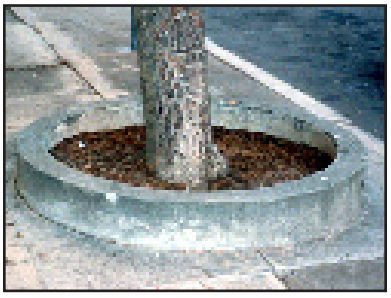
When sidewalks and roads damaged by tree roots need repair, more tree-friendly methods can be used. Instead of removing surface roots to restore pavement to its prior level, concrete or asphalt ramps can be built over or around roots. To bridge the gap between uneven slabs of concrete, asphalt wedges can be installed. If pavement displacement is less than one inch, grinding down the edge of the raised surface can be an effective solution.

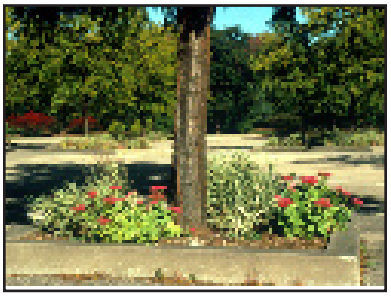
Alternatives to pavement repair involve the initial use of, or replacement with, other paving materials. One alternative is landscape pavers, porous concrete pavers that can also be used for parking lot surfaces instead of solid asphalt or concrete. A second alternative, still being developed in California, is the use of rubber sidewalks. Rubber sidewalks, made from compressed, recycled crumb rubber (mainly from recycled tires) provide malleable paving surfaces that give way to invasive tree roots. Rubber sidewalks are cost-effective and aesthetically acceptable alternatives to conventional paving materials. Though rubber sidewalks may bend a bit out of shape in response to aggressive roots they do not create abrupt edges over which pedestrians might trip, and they provide a softer surface should someone fall on them.

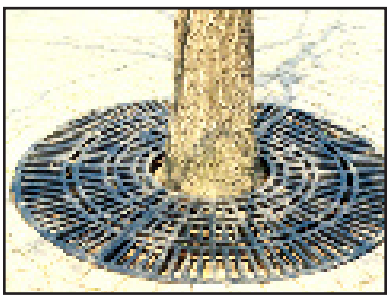
Tree planting pits

Tree planting pits in sidewalks need not always be designed as individual "containers." Tree pits can be constructed so that a continuous channel of soil under the pavement connects the individual pits and allows greater volumes of soil for root growth and water storage. Raised tree planting areas can likewise be designed to accommodate multiple rather than single trees.

Where individual pits must be constructed they can either be above, at or below the surface of the pavement. If they are above, extra provisions must be made for supplemental fertilization and irrigation. If they are at surface level, plant a ground cover at the time of tree installation to discourage foot traffic over the tree roots (see VCE Publication 426-609 – Selecting Landscape Plants – Ground Covers). If the pit soil level will be 2 – 8 inches below the pavement surface, install an adjustable pit cover or grate. The cover or grate will accommodate tree trunk growth while reducing trash accumulation and rodent habitation.







Trees for parking lots and paved areas*:

Common Name	Latin Name	Cultivars and Comments
Hedge maple	*Acer campestre*	
Amur maple	*Acer ginnala*	
European hornbeam	*Carpinus betulus*	'Fastigiata'
Katsuratree	*Cercidiphyllum japonicum*	
Cornelian cherry	*Cornus mas*	
Cockspur hawthorn	*Crataegus crusgalli*	use thornless variety inermis
Arizona cypress	*Cupressus glabra*	'Blue Arizona'
Green ash	*Fraxinus pennyslvanica*	potentially large tree
Ginkgo	*Ginkgo biloba*	'Fastigiata', 'Princeton Sentry'
Honeylocust	*Gleditsia triacanthos*	use thornless variety/cultivar inermis 'Shademaster'
Foster's holly	*Ilex* x *attenuata*	'Fosteri'
Savannah holly	*Ilex* x *attenuata*	'Savannah'
Chinese juniper	*Juniperus chinensis*	'Torulosa' (Hollywood juniper)
Rocky mountain juniper	*Juniperus scopulorum*	'Pathfinder', 'Skyrocket', 'Wichita Blue'
Eastern redcedar	*Juniperus virginiana*	'Burkii'
Goldenraintree	*Koelreuteria paniculata*	
Japanese crape myrtle	*Lagerstroemia fauriei*	'Apalachee', 'Dynamite', 'Fantasy', 'Ludi', 'Wichita', 'Zuni'
Southern magnolia	*Magnolia grandiflora*	'Alta', 'Hasse', 'Little Gem'
Sweetbay magnolia	*Magnolia virginiana*	
Crabapple	*Malus baccata*	'Columnaris'
Crabapple	*Malus* x	'Sentinel'
American hophornbeam	*Ostrya virginiana*	
Persian parrotia	*Parrotia persica*	
Chinese photinia	*Photinia serrulata*	
Chinese pistache	*Pistacia chinensis*	
Sawtooth oak	*Quercus acutissima*	
Scarlet oak	*Quercus coccinea*	potentially large tree
Overcup oak	*Quercus lyrata*	potentially large tree
Swamp chestnut oak	*Quercus michauxii*	potentially large tree
Chinese evergreen oak	*Quercus myrsinifolia*	
English oak	*Quercus robur*	'Fastigiata'
Japanese pagodatree	*Sophora japonica*	
Pondcypress	*Taxodium ascendens*	potentially large tree
Arborvitae	*Thuja occidentalis, T. orientalis, T. plicata*	
Littleleaf linden	*Tilia cordata*	
Lacebark elm	*Ulmus parvifolia*	
Chastetree	*Vitex agnus-castus*	
Japanese zelkova	*Zelkova serrata*	

*Confirm mature height and spread, and cold and heat tolerance, for appropriateness for your geographic site and location before planting.

Trees unsuitable for restrictive paved areas due to large surface roots:

Norway maple	*Acer platanoides*
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
River birch	*Betula nigra*
Hackberries	*Celtis* spp
Beeches	*Fagus* spp.
Sweetgum	*Liquidambar styraciflua*
Southern magnolia	*Magnolia grandiflora*
London planetree	*Platanus* x *acerifolia*
American sycamore	*Platanus occidentalis*
Pin oak	*Quercus palustris*
Willow oak	*Quercus phellos*
Live oak	*Quercus virginiana*
Weeping willow	*Salix babylonica*
American elm	*Ulmus americana*