



Improving the Success of Roadside Tree and Shrub Plantings

Ornamental plantings are a means to blend the stark utility of roadways with their surroundings by improving the aesthetic and environmental qualities of the roadside. Roadside plantings are also an effective way to improve community relations. To get an overview of design and installation concepts of ornamental plantings along roadsides, read PENNDOT Publication 461, *Roadside Planting Guidebook*, available through the Bureau of Maintenance and Operations, or online at <http://www.dot.state.pa.us>.

The advantage of using trees and shrubs for roadside plantings is their long lives and large size - they can make a positive visual impact for a long time. Additionally, the long-term maintenance requirements for trees and shrubs are much lower than for herbaceous ornamental plantings.

This factsheet addresses planting issues that arise when installing a planting *after* the road is built, and will highlight three areas that greatly affect the survival, growth, and eventual visual impact of trees and shrubs planted along roadsides-

- *Plant selection and handling*
- *Site preparation*
- *Maintenance*

PLANT SELECTION AND HANDLING

The roadside environment is harsh. Sites usually have been drastically disturbed during construction, resulting in shallow, compacted soils with little or no topsoil. These soils are not favorable for supporting ornamental plant growth. The corridors formed by the roadway become natural 'wind tunnels'. On top of that, roadside plants are exposed to vehicle emissions, and salt spray in the winter. Undertaking a roadside planting is not like a residential planting - special measures need to be taken to ensure success.

The plants selected for use along roadsides must be able to withstand harsh conditions. This is not simply a matter of using plants adapted to Pennsylvania conditions. The conditions along the road are not natural - *nothing is native to a roadside*. Though our state flower and state tree - mountain laurel and Eastern hemlock - occur throughout Pennsylvania, they will not tolerate the exposed conditions and poor soils commonly found along roadsides.

Select the Best Plants for the Site

You may be approached by well-meaning community groups who can bring valuable resources to a partnership - but the most important ingredient is a landscape designer who understands the safety and environmental constraints of roadside plantings.

A lot of effort in establishing a planting should go into selecting the planting site, and the plants for that site. The easiest way to accomplish this is to have a competent designer who understands the challenges of growing plants along the highway. The site must be highly visible, but the planting cannot compromise roadway safety or engineering function.

Once you have developed the visual theme and determined the viewing points for your planting, the designer can begin assembling the plant list. The best plant may be identified by its species, but in many situations it will be identified more specifically as a named variety of a species.

What is a Plant 'Variety'?

A variety (or cultivar) has reproducible, desirable characteristics that are not common to the species at large.

Varieties are selected for certain characteristics that may be extremely important to particular sites. These characteristics include variations in hardiness, size, form, leaf color, and fall coloration. There are several very commonly used tree species that are native to wide geographic regions. For example, red maple grows in the wild from New England to the Gulf of Mexico. It's one species, but it is comprised of many populations with traits particular to where they grow. Red maples grown from seed collected in the southern U.S. will not survive in New England. If you are going to plant trees with a vast geographic range, it is best to specify a known variety.

Green ash is *Fraxinus pennsylvanica*. 'Marshall's Seedless' green ash is a variety with male-only plants that does not produce seed. When you order this plant, it is important to order by the common name (green ash), Latin name (*Fraxinus pennsylvanica*), and the variety name ('Marshall's Seedless'). Designers must be extremely careful to order exactly what they want, and inspectors must check every plant that they receive to assure the species and variety received is correct.

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Plant Handling and Care Before Planting

A valuable resource to assist you in making sure your plants are of high quality and receive the best care possible is PENNDOT Publication 450 - *Roadside/Landscape Development Construction Inspection Handbook*, which is available in both hardcopy and online.

Although you may not be installing a planting as part of a construction project, it will be easier to develop a clear contract or agreement to install a roadside planting by relying on Publication 450 and PENNDOT's established procedures for specifying and inspecting plant materials and site preparation on construction projects.

Quality Plantings Require Quality Inspection

The best design is doomed to fail if the plant material is not properly inspected when it arrives on site.

Use the guidelines in Publication 450 and PENNDOT's Plant Material Inspection Report (CS-6104) to insure a thorough inspection.

A few fundamental points to follow during inspection include:

- Have the inspector(s) meet the delivery. No plants should be unloaded until they are inspected.
- Insist that all trunk wrap be removed prior to inspection, and inspect *each* plant.
- Inspectors must verify the identity of the plants, that they were handled and transported properly, and that each plant meets the acceptable standards.

Available Forms of Woody Plants

The most common form to purchase trees and shrubs is balled-and-burlap, or B&B. When these plants are harvested for sale, the root ball is dug and lifted from the soil and wrapped in burlap, and secured with heavy twine or a wire basket. B&B plants lose 50 to 95 percent of their roots when they are harvested, depending on the species, and the growing and harvesting practices. Other forms of woody plant materials that are not commonly used for roadside plantings include bareroot, and container-grown.

Despite their lower cost, bareroot plants are not commonly used for roadside planting projects because their handling is extremely time-and-method sensitive. The primary drawback to container-grown plants is that the soil-less media they are grown in does not retain as much water as soil, and they require more watering after planting. Container-grown woody plants will be more widely used in the future, especially as the demand increases for native tree species. Many native species have been difficult to produce with traditional field practices, but are more easily produced using container production techniques.

Water - the Key to Plant Survival

The biggest threat to plant survival between the time they are dug in the nursery and planted in the landscape is

drying out. The plant you have purchased has lost most of its roots, and the small amount of remaining soil is now exposed to the drying air on all sides, not just the top. It is critical that everything possible be done to *minimize the loss of water* from the plant and the soil, and it is equally critical to *supply water when needed*.

The best way to minimize water loss is to minimize the length of time between the digging of the plant in the nursery and planting it at your site. Place your order and arrange the delivery of your trees and shrubs so that they arrive when you are ready to plant.

When placing your order for plant material, your specifications should include clear directions for the shipping and handling of the plants.

- Plants should not be delivered to the planting site more than two days prior to planting.
- All plants should be in an enclosed, ventilated truck box or entirely covered with tarps during shipping.
- If planting is delayed, place the plants in a holding area where they can be irrigated, and cover the root balls with mulch to reduce water loss.

You will have to water after planting, so make sure that the arrangements to irrigate are in place before planting. This way, if your planting is delayed, you can keep your plants watered until they are in the ground.

SITE PREPARATION

Eliminate Weeds

Newly planted trees are under considerable stress from the transplanting process. Their survival and growth depends on the rapid re-establishment of their root systems. Competition from the roots of other plants growing in the area slows their re-establishment. The roots of weeds and grasses not only directly compete with the emerging roots of your new plants; they can also produce chemicals that inhibit the growth of other plants. All vegetation in the planting bed of newly planted trees and shrubs should be eliminated prior to planting.

Improve the Soil

Existing roadside soils are rarely suitable for an ornamental planting. The survival and growth of newly planted trees and shrubs depends on the rapid re-establishment of their root system. For root growth to occur the soil must be loose enough (have adequate pore space) for roots to penetrate and to provide an ample supply of water and oxygen. The severely compacted soils that result from roadside construction do not provide any of these features. Roadside soils are often better described as an engineering substrate rather than a plant growth medium.

The amount of effort and resources required to

make the soil suitable for planting should be a primary consideration in site selection. Although most of a tree's roots occur in the top six inches of soil, the soil depth available for rooting needs to be measured in feet, not inches.

Turning a poor roadside soil into a functional soil for ornamental plants is no small undertaking. Start with the best soil you can to minimize soil improvement efforts.

Restoring Topsoil Function

Soil is not just a collection of different-sized mineral particles. When growing plants, you need to see the soil as a living organism - sort of a 'collective being'. A living soil gives life to your plants, and what gives life to the soil is organic matter, or *humus*. Humus is the 'active ingredient' of topsoil. Within this organic fraction of the soil, there are countless microscopic life forms performing chemical and biological functions that are just beginning to be understood. This living community is what makes the soil a productive growth medium for your plants. Humus improves soil aeration, water retention, fertility, and the soil chemical processes necessary for plant growth. Most roadside soils lack organic matter due to the removal of the topsoil, so adding topsoil or organic matter back to the soil is often a necessary component to a successful planting.

Loosening the Soil

The soil in the planting site should be loosened in as large an area as possible, and as deeply as practical prior to planting. The ideal approach is to treat the planting site as one large bed, rather than loosening individual planting pits.

On very poor sites, you may need to avoid trying to loosen the existing soil, and simply truck in the soil and create a raised planting bed. The obvious drawback to this is the cost of the soil, the hauling, and the grading involved.

The more likely scenario is that you will loosen the existing soil as deep as practical, and amend the soil with topsoil, organic matter, or both, to improve the soil and provide a reasonable rooting depth.

Roadside soils were 'created' by construction equipment, and may have large rocks or other fill material close to the surface. Construction-grade equipment would be the best tool to undo the damage, but obtaining the services of a ripper may not be feasible. An implement such as an agricultural-grade sub-soiler may be your best option (Figure 1). A roto-tiller is well suited for mixing amendments into the soil, but may not be durable enough for the initial loosening.

Amending the Soil

The easiest way to restore topsoil function is to add topsoil to the site. If topsoil is not available, then add organic matter to the soil. The best sources of organic matter are composted materials. These have already gone through considerable digestion and modification by microorganisms, and provide biological and chemical

stability to a soil.

There are no clear guidelines on how much topsoil to add to a poor site. If your site does not have any topsoil, add at least six inches. If the soil cannot be adequately loosened to provide necessary rooting depth, you must add the necessary soil to the site.

When adding topsoil or organic matter to the planting bed, avoid creating a sharp boundary - or discontinuity- between the added soil and the existing soil. After loosening the existing soil, incorporate the new material. The objective is to incorporate as much as you can as deeply as possible. If you are using a typical roto-tiller, limit the amount of material to be incorporated to three inches at a time.

If you cannot loosen the existing soil over the entire site, add the necessary soil to the site, and use a backhoe to break through the compacted layer by loosening large planting pits as described in Publication 450.



Figure 1. A sub-soiler (above) a tillage implement with few, stout, non-moving parts is recommended for initial loosening of roadside sites. Roto-tillers are more suitable for incorporating topsoil or organic matter.

Shared Spaces - Cluster Plantings

The concept of shared spaces, or cluster plantings, works extremely well for difficult sites such as roadsides. In this approach, the planting area is treated as a large bed, and the plants are spaced close enough together so that they grow together, both above and belowground. By grouping the plants together, they begin to modify and improve the environment in their immediate vicinity.

Preparing the planting as a large bed provides more soil volume for the roots to explore for water and nutrients. As the canopies of the closer-spaced plants begin to come together, more of the soil surface is shaded, moderating temperature extremes. As the soil temperatures are moderated, the soil retains moisture better, and a more complex spectrum of soil microorganisms develops around the roots. As the soil improves biologically, soil nutrients are retained and

cycled more effectively, and the trees and shrubs respond with more vigorous growth.

A cluster planting will cover less area, but offers the following benefits:

- The closer spacing will provide a more striking planting in a shorter amount of time.
- The individual plants will grow better, with higher survival.
- Cluster plantings are easier to maintain because they occupy less acreage and as they mature there is less space and light to support weed growth.

MAINTENANCE

Though often arranged for last, *maintenance is the most important element in planting survival*. Do not establish a planting until you have arranged the necessary resources for maintenance.

Water

Water is the key element in the establishment of new plantings. Trees and shrubs should be watered thoroughly at the time of planting and several times during the early establishment phase. The use of irrigation bags, or any large container that will trickle water to the soil is the best way to irrigate large plants. However, just forming a moat around the new plants with soil will allow enough water to be quickly added without too much of it running off to surrounding areas. When conditions are dry after planting, your watering efforts are the difference between life - a successful planting - and death - money and effort wasted.

Fertilization

The safest and easiest practice is to place slow-release fertilizer tablets or packets in the planting hole with each plant, according to label recommendations. The risk of burning roots with misapplied granular fertilizers is too great to make a recommendation for their use. The best fertilization practice is to have adequate topsoil and control weeds.

Pruning

It is important to develop well-spaced structural branches early in the life of a tree. Branches that are growing close together when young will grow into each other with age, and they will not be able to develop their full structural strength. Once the structural branches have been established, little pruning should be needed.

Because shrubs have so many forms and densities, there are many different ways to prune them. Viburnums develop strong trunks and branching structures. Other than occasional removal of dead, crossing, or parallel branches, little pruning is needed. Junipers may never need to be pruned. Shrubs like forsythia, abelia, and gray dogwood can be cut to the ground every 2 to 4 years and will grow right back. How shrubs are pruned depends on the availability of funds and skilled people to

decide the proper way to prune the different plants.

Remove Bracing

Tree bracing is a temporary measure to stabilize plants until they root securely in their new site. Bracing should be removed after the first growing season to reduce the possibility of plant damage, and to improve the appearance of the planting.

Mulch

Applying mulch at planting, and maintaining it for several years, helps hold moisture in the soil, suppresses weed germination, and keeps trimmers and mowers away from your plants. The best mulch is a 2 to 4 inch layer of wood chips. Wood chips are less expensive and last longer than the aged ground bark and wood mulches. Wood chips are also readily available as a product of roadside brushing.

Using Black Plastic

Prior to spreading mulch, install black plastic around each of your plants. Black plastic is an inexpensive and highly effective way to provide excellent weed control under trees and shrubs. Plastic mulch prevents weeds from emerging from the soil, and prevents weeds germinating in the mulch from getting their roots to the soil. There is no PENNDOT specification for black plastic mulch, so you will need to develop your own language to include it in a contract or agreement to install plant material.

Weed Control

Mulch will prevent a significant amount of weed growth, but weeds will eventually appear. Your maintenance program should include at least one annual application of an herbicide that prevents weed growth from seed, as well as an annual visit to remove weeds that escaped the treatment. These plants can be pulled or spot-treated with an herbicide product containing glyphosate. Routine visits will prevent the establishment of troublesome perennial weeds.

SUMMARY

Plants introduced to the harsh roadside environment need all the help they can get to survive and grow. Establishing successful roadside plantings takes much more effort than in parks or yards.

The key points you must follow for success are

- Start with a skilled landscape designer, who will choose the best available site and plants adapted to that site.
- Arrange for thorough inspection of the plants, site preparation, and the planting practices. Rely on Publication 450 for inspection guidelines.
- Invest in maintenance - if you can't, do not plant.