

CHAPTER 4

DESIGN DEVELOPMENT

To design an attractive roadside enhancement project, one should be familiar with some basic principles of design. This chapter covers how the building blocks of design and some common roadside materials can be applied through various design approaches to improve roadside aesthetics.

BUILDING BLOCKS OF DESIGN

The building blocks of any appealing landscape include the following elements: line, form, texture, color, scale and proportion, balance, pattern and repetition, focal point and emphasis, and depth. These building blocks apply to planting design, roadside vegetation management, and the choice and application of hardscape materials. When properly combined, these design elements will result in a visually pleasing landscape.

Line

In the landscape, lines are the edge between two surfaces or features. For instance, line refers to the edge that a mower creates against a stand of tall grasses, the edge of a planting bed, or the edge of a tree line or a shrub mass. With hardscape materials (i.e., pavement, guardrails, etc.), line is often more explicit than the implied line created by two types of vegetation as it draws the eye toward the structure.

Straight lines draw the eye to a focal point and do not allow the eye to rest until it identifies a break in that line. Straight lines should complement other lines in the landscape such as the edge of the roadway, a building or a wall. Because straight lines and defined edges are prevalent in urban environments, the urban classification is most appropriate for geometric and highly organized design elements. Sometimes site constraints will only allow for straight lines; for instance, green space between roadways and adjacent parking lots may only allow enough space for a linear row of shrubs or trees.

Curvilinear lines can soften a linear landscape and relate to the natural environment. Curvilinear lines suggest a slow progression that allows the eye to capture the surrounding landscape. In the roadside environment, the curve should be gradual and non-uniform. If the land form within the right-of-way has any variation in its topography, the line



Straight line created by sidewalk edge and hedge



Curvilinear line used to define a planting bed



The roadway and wall respond to the natural land form

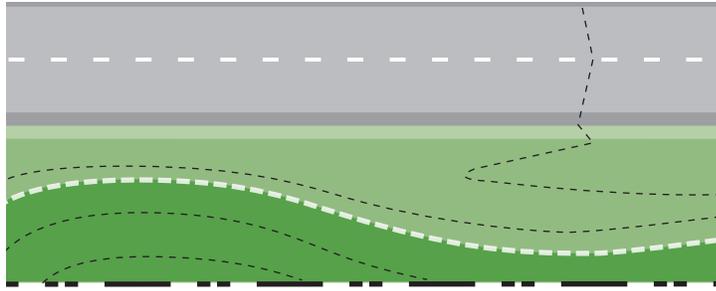
should follow the topography and run parallel to the contours. To create interest in a landscape with no variation in topography, use a curvilinear planting and/or mowing pattern to add depth. Gradual and non-uniform curves, similar to a low frequency wave, that follow land form and natural features, such as tree lines, are better than curves with a high frequency that do not respond to landscape features.

Curvilinear lines are associated with natural environments, but are also used in formal design. Spirals, circles, ellipses and symmetrical curves are best suited for urban and suburban environments.

Some hardscape materials occur in the roadside environment out of functional requirements (e.g., noise barriers, retaining walls, etc.) and do not always relate to a site's context. The visual impact of the lines that hardscape creates can be reduced by designing them to respond to the natural landform. Plants are also a practical and effective way to soften straight lines of structures.

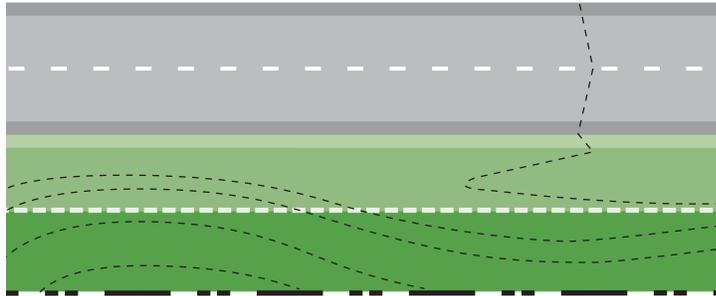


Curvilinear lines can soften a linear landscape and add visual interest to the roadside environment

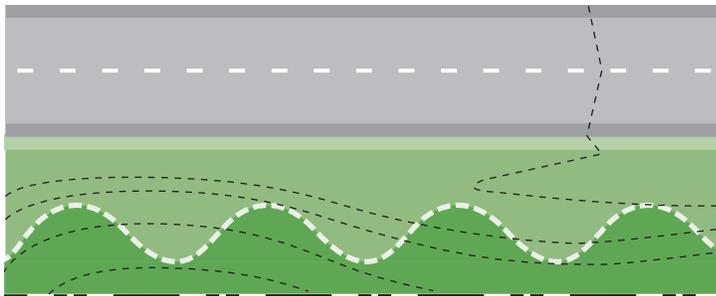


----- Contour Lines (Land Form)

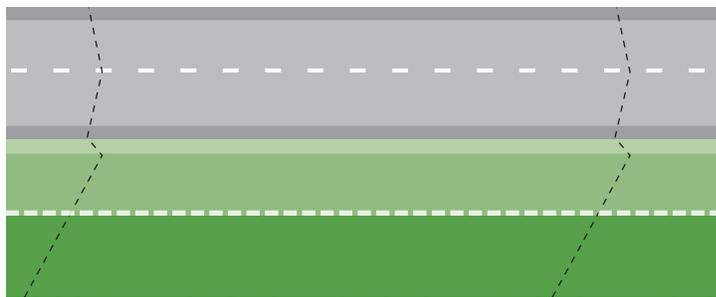
✓ The curvilinear edge follows topography and has a more natural appearance



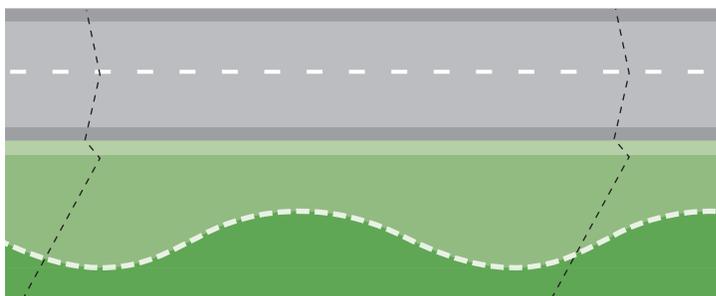
✗ The straight edge does not follow topography and is more difficult to maintain/mow



✗ The “high frequency” curvilinear edge does not follow topography and is more difficult to mow/maintain



✓ On relatively flat roadside, a straight edge creates a clean or groomed appearance

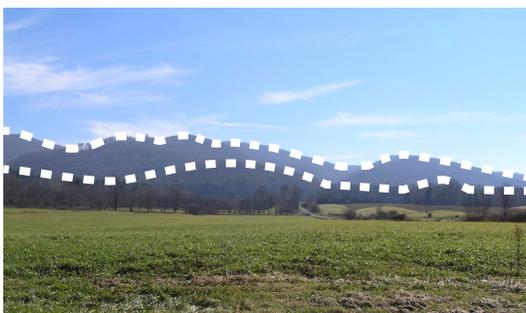
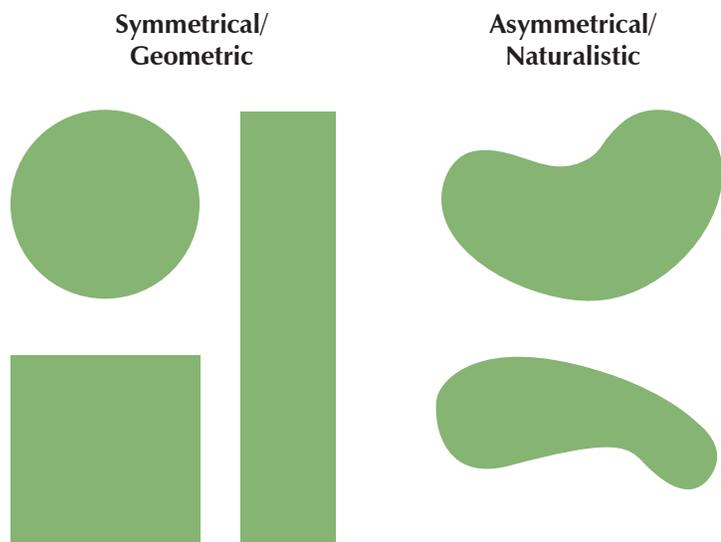


✓ A “low frequency” of gradual curvilinear line creates interest in a roadside environment with little topographic variation

Form

Form refers to the three-dimensional quality of landscape elements including plant materials, planting beds and existing land form. Common plant forms include round, vase-shaped, columnar, spreading, pyramidal and weeping. When many plants are combined, either of a single species or a combination of species, the form of the group or mass is more noticeable than the individual plant. Plants can also be trimmed into a desired form, as is often done with shrubs.

Planting beds forms can be described as symmetrical or asymmetrical, in both bed shape and the profile created by the mass of plants. Symmetrical or geometrical forms are most appropriate for urban and suburban environments. Asymmetrical or naturalistic forms generally fit within rural landscapes but can be found in suburban landscapes as well.



Form in the natural environment

Existing landscape form is evident in topography (e.g., mountains, bluffs, rolling hills), masses of natural vegetation and structures. Tennessee has three regions of distinct natural form: East (mountains), Middle (flat-topped mountains and deep valleys) and West (low hills and bottom lands). Throughout the state, views of land form provide enhancement opportunities that require little design intervention other than maintaining viewsheds that showcase the natural land form.



Pyramidal

Pyramidal forms have wide spreading branches at their base and narrow tops. Pyramidal trees give a feeling of formality. They are effective at adding height while screening low-level views. Some tree species only appear pyramidal when they are young, but change to a more rounded form as they age.

Examples include:

- American Sweetgum (*Liquidambar styraciflua*)
- Ginkgo (*Ginkgo biloba*)
- Baldcypress (*Taxodium distichum*)
- Pin Oak (*Quercus palustris*)
- Eastern Hemlock (*Tsuga canadensis*)
- American Holly (*Ilex opaca*)
- Southern Magnolia (*Magnolia grandiflora*)
- White Pine (*Pinus strobus*)

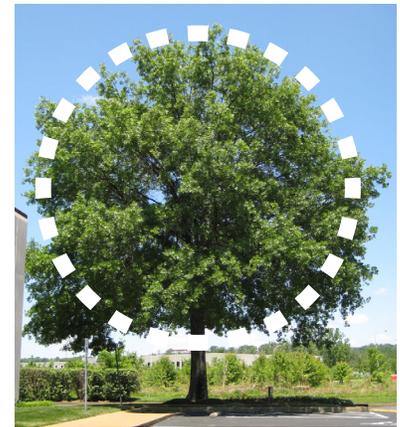
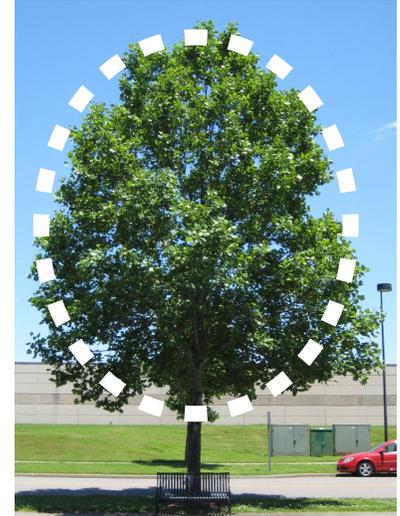


Columnar

Columnar form is narrow and vertical. Columnar vegetation can add height to a landscape, be planted in narrow corridors where space is limited and can screen tall features. Columnar trees are often used in lines or as a focal point.

Examples include:

- Eastern Redcedar (*Juniperus virginiana*)
- Fastigate English Oak (*Quercus robur* 'Fastigiata')
- European Beech (*Fagus sylvatica* 'Dawycykii' or 'Fastigiata')
- European Hornbeam (*Carpinus betulus* 'Fastigiata')
- Lombardy Poplar (*Populus nigra* 'Italica')



Round

Round form is spherical or rounded in shape. It can be used to soften compositions or serve as a focal point. Round vegetation is very common and offers much versatility in the landscape.

Examples include:

- Serviceberry (*Amelanchier arborea*)
- Red Maple (*Acer rubrum*)
- Sugar Maple (*Acer saccharum*)
- Red Oak (*Quercus rubra*)
- Willow Oak (*Quercus phellos*)

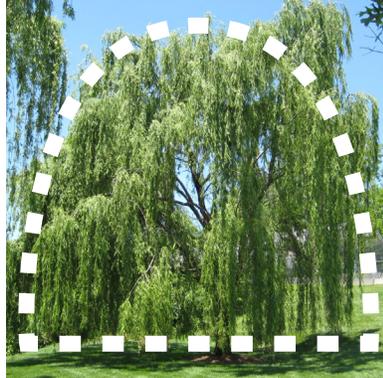


Spreading

Spreading form is characterized by broad branches that spread or reach away from the trunk. Spreading trees can be effective at screening objects above eye level, creating shade, and filling a space with fewer plants. If they are planted in at regular intervals and kept clear of understory vegetation, spreading trees can create a grove that draws the eye in and is aesthetically pleasing.

Examples include:

- Redbud (*Cercis canadensis*)
- Flowering Dogwood (*Cornus florida*)

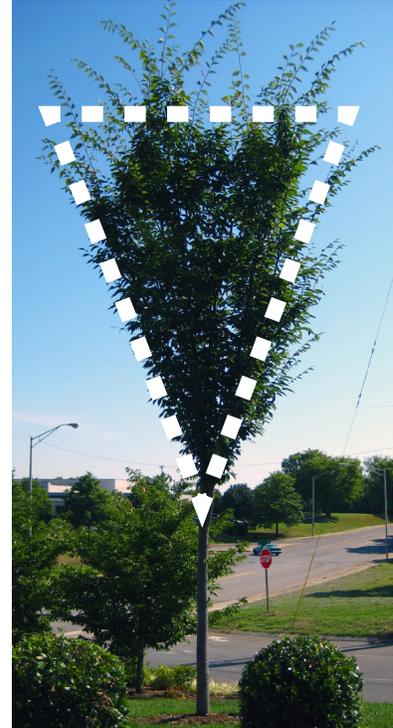


Weeping

Weeping form is an irregular profile with branches that turn to the ground rather than the sky. The weeping form implies movement and can give a “light” feeling to a landscape. Weeping trees species are very effective focal points.

Examples include:

- Weeping Atlas Cedar (*Cedrus atlantica* ‘*Glauca Pendula*’)
- Weeping Willow (*Salix* sp.)
- Weeping Cherry (*Prunus subhirtella* ‘*Pendula*’)
- Weeping European Beech (*Fagus sylvatica* ‘*Pendula*’)



Vase

Vase-shaped trees are narrow at the base and broader at the top. They are well suited to the streetscape environment as their branches allow for clearance of vehicles and pedestrians. Used in mass, the canopy of vase-shaped trees will create an effect similar to an arched or cathedral ceiling.

Examples include:

- Japanese Zelkova (*Zelkova serrata*)
- Crape Myrtle (*Lagerstroemia* sp.)
- Kwanzan Cherry (*Prunus serrulata* ‘*Kwanzan*’)
- Lacebark Elm (*Ulmus parvifolia*)
- American Elm (*Ulmus americana*)

Texture

Plant texture is usually described as being fine, medium or coarse. Due to roadway traveling speeds, the texture of a single plant is not always noticeable. Texture is most noticeable to pedestrians or on low speed roadways where plants are typically closer to the traveled way and passerby have more time to take in their surroundings. In general, texture in the roadside environment is more effective by grouping plants with similar textural qualities. For instance, at a distance, a group of trees with fine textured leaves appears flat with little visual depth, whereas coarse textured leaves create depth with light and shadow. Plants of varying textures can be combined in a landscape composition to provide contrast and more visual interest.

Texture can be applied to hardscape elements as well. A noise barrier or bridge abutment with a stamped pattern creates more interest by adding depth to the concrete surface.



Texture is noticeable at close range and at lower speeds



Texture is lost in the distance and at higher speeds



Texture can be used in hardscape elements, like this concrete wall, to add visual interest



Color treatment on a noise barrier



Bold use of color in an urban area



Fall color in eastern Tennessee

Color

Color is a powerful tool in the landscape. While seasonal color change exists in most landscapes, color can also be added to the landscape with vegetation and hardscape. Colors should be selected with respect to the site’s context.

At a small scale, a variety of colors can be used, but are most noticeable at close range and low speed roadways. For most interstates and state routes, masses of a single color or shades of the same color are most effective.

On a regional or large scale, color can be used at selected sites along a corridor to provide seasonal interest or to create a consistent theme. Using the concept of repetition, color can establish a sense of place or identity for a community.

It is best to add subtle color application to hardscape materials to minimize their visual impact. Neutral colors tend to blend into the surroundings and offer minimal contrast. Bold colors are best used to emphasize a feature and should fit the context of the location (e.g., surrounding buildings, local university colors, etc.).

It is very important to consider color around signage, as color can have an impact on a sign’s visibility. Avoid using colors that will hide signs or make them difficult to read. For example, avoid planting vegetation with red flowers or red fall color around a stop sign.



Large areas of color make a dramatic impact

Scale and Proportion

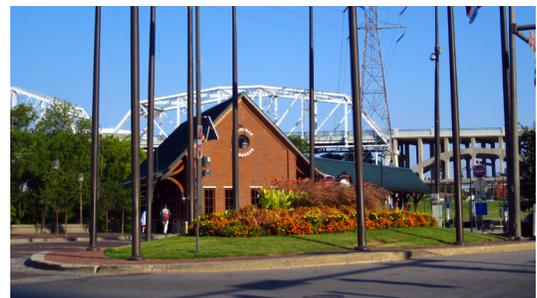
Scale and proportion describe the ratio of the planting area to the area around it and the planting area to the plant size. The feeling of a space (e.g., open, enclosed) is influenced by the size of plants and structures in relationship to the objects and areas around them. In many cases, a designer may be forced to compromise scale and proportion to accommodate site conditions. For example, narrow planting strips or overhead power lines may prohibit the use of large trees that are more appropriate for the scale or goals of the project.

To apply this concept to a roadside enhancement project, identify the boundaries of the space. In an interchange, this space may be the land between two convergent roadways. In smaller settings, it may be the green space at an intersection, within a median, or the area between a roadway and a right-of-way fence. Once the area is identified, divide it into thirds for proportional planting areas. Within each area, the tallest plants' mature size should measure one or two thirds ($1/3$ or $2/3$) the width of the planting area. This concept is not necessary to follow when planting a monoculture, but when plants are used in combination with one another, this ratio can improve the aesthetics of a design.

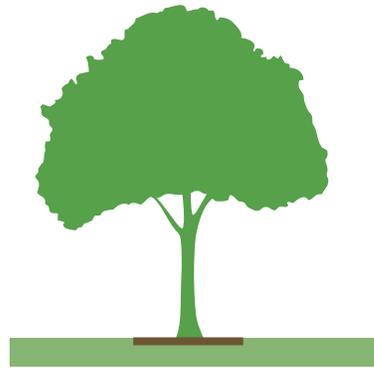
This ratio prevents plantings from appearing out of scale to their surroundings. For instance, a planting bed that is one eighth ($1/8$) the area of a green space will appear lost within the larger context, which can be distracting to the viewer. Likewise, plants that are too tall for a small planting bed may appear crowded or overgrown.



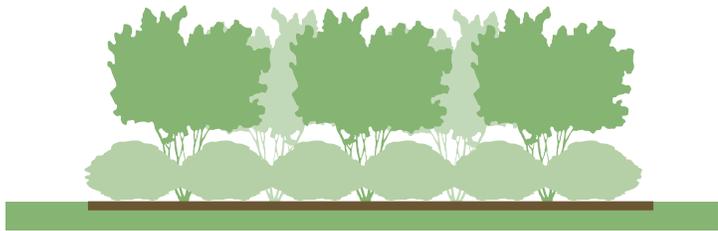
This planting bed illustrates good scale and proportion



This planting bed is approximately two thirds ($2/3$) the size of the roundabout island



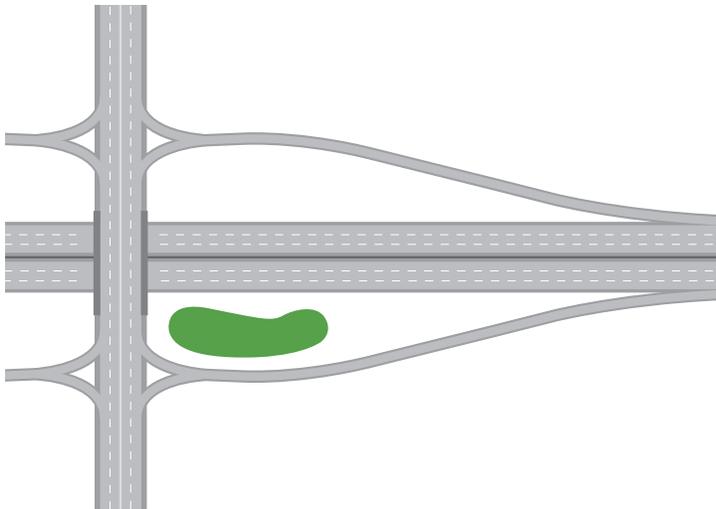
The width of the planting bed or mulched area is one third (1/3) the height of the tree



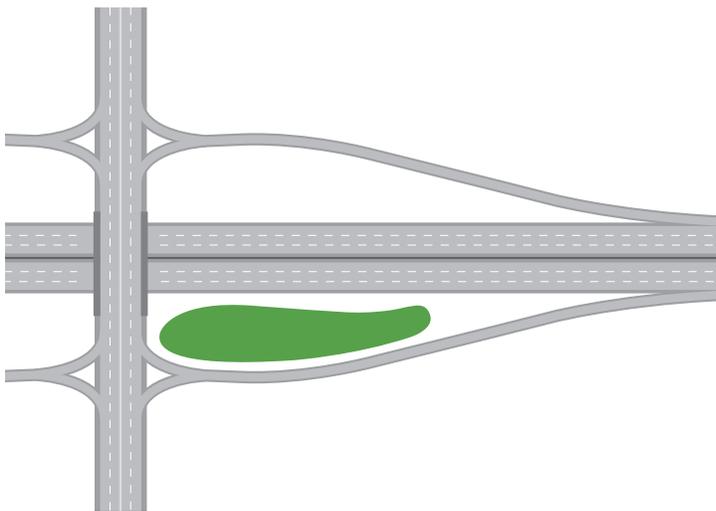
Planting bed width is three times the height of the tallest plant



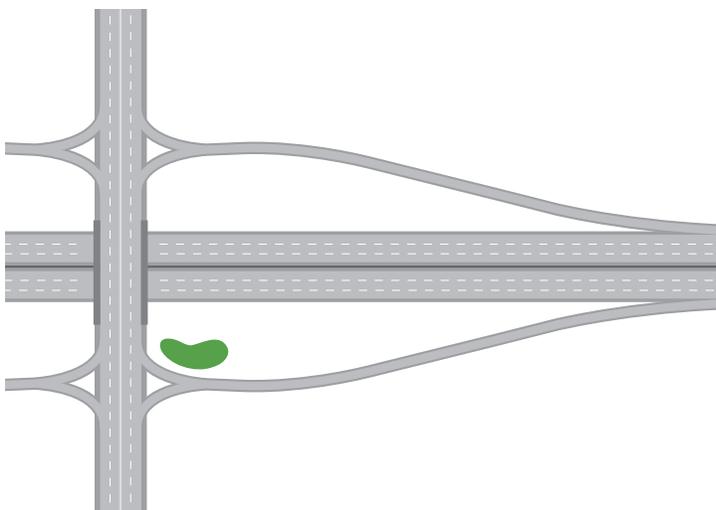
Planting bed width is three times the height of the tallest plant



✓ The planting bed is one third (1/3) the size of the area of the island



✓ The planting bed is two thirds (2/3) the size of the area of the island



✗ The planting bed is too small for the area of the island and appears out of scale



This planting bed is symmetrically balanced by using the same species and number of plants on each side of the central axis

Balance

Balance refers to symmetry or asymmetry and can apply to color, quantity, size and texture with relation to a central axis. Balance can simplify complex landscapes. Symmetrical landscapes are usually formal and are often associated with urban or suburban environments (e.g., boulevards/promenades, entrances to business parks). Asymmetrical landscapes are associated with more natural landscapes but can be applied in any context.

One way to achieve symmetrical balance is to use the same number of plants on either side of an axis, particularly identical plant species. If the number of plants is different on each side an axis, this can create an asymmetrical planting; however, other visual qualities, such as color, size and texture, will compensate to create balance.



Balance created by identical conditions on both sides of the roadway

Balance in a broader context applies to the types of vegetation or land use on either side of a road. For instance, vegetation on one side of the road and buildings on the other may appear unbalanced. Planting trees on the side of the road with buildings will help to balance the composition.



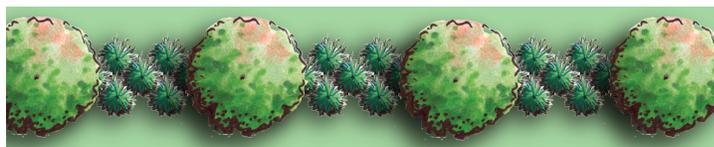
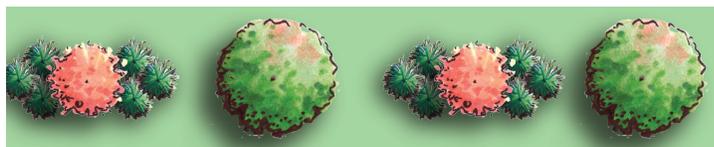
Balance created by trees of different species but equal height on both sides of the roadway

Pattern and Repetition

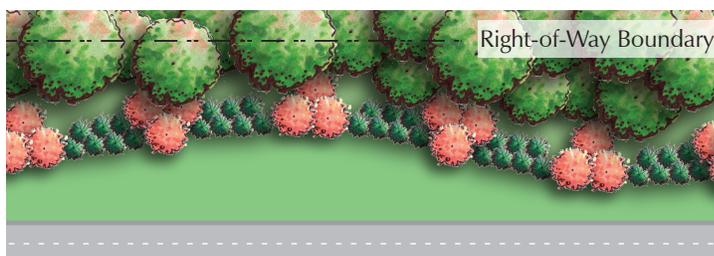
Pattern is created by repetition. In the roadside environment, pattern is evident in the arrangement of plants, the placement of mass plantings along miles of roadway, or the arrangement of street trees in a streetscape. Pattern can also be seen in hardscape materials, such as ornamental paving patterns, modular walls and noise barriers.

To create a pattern along a roadway corridor (Figure 4.1), repeat identical or complementary plant and hardscape materials. Pattern creates a cohesive landscape by repeating elements like color, form and plant species. For example, a community could install identical or similar planting beds at multiple interchanges. This would indicate to a motorist that each of these interchanges will take them into that community and links a particular design to a place by establishing an identity.

Pattern can also be created in hardscape elements like noise barriers and retaining walls. Changes in color, texture or form provide visual interest and prevent monotony.

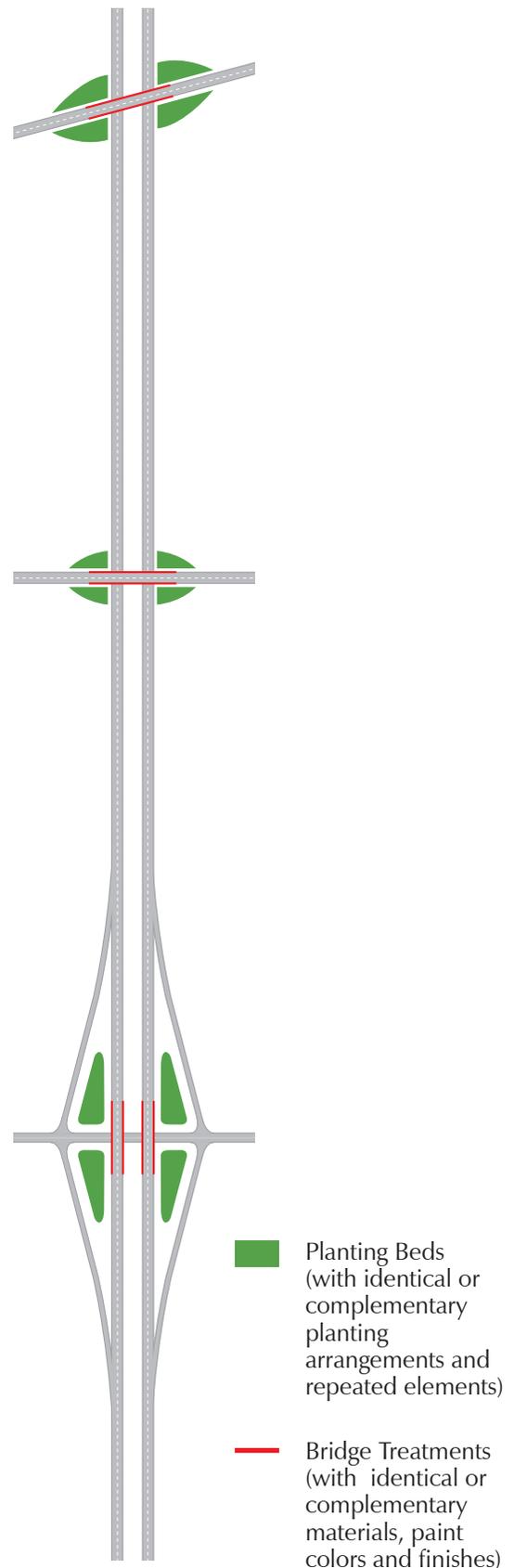


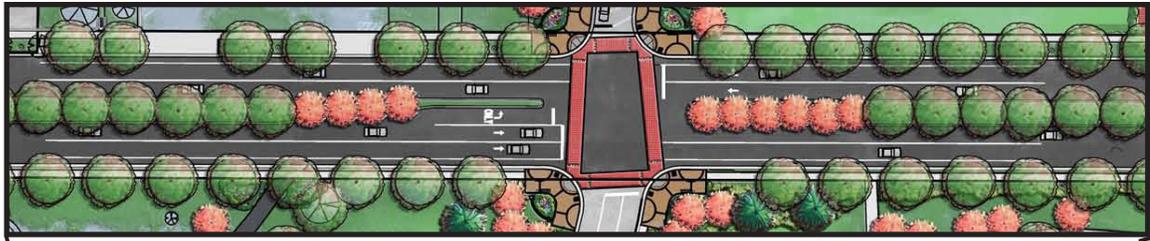
Formal patterns can be created by repeating identical plant materials and using consistent spacing



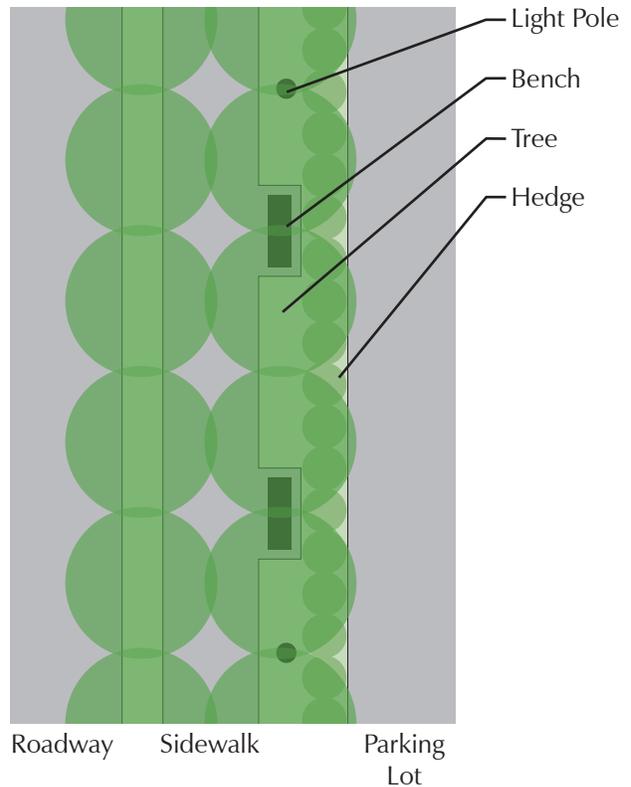
Pattern can be created along a right-of-way with an existing tree line by planting masses of identical plant materials at regular intervals

Figure 4.1: Pattern on a Roadway Corridor





This streetscape plan uses pattern to establish a unique identity along this one-mile corridor at the edge of a university campus



The photograph and illustration above show pattern created by the repetition of multiple elements: light poles, benches, trees and shrubs (hedge)

Focal Point and Emphasis

Focal points are typically unique features in the landscape, such as a land form, a specimen tree, public art or an architectural feature. A focal point can also be a common structure or mass of vegetation, or any place where the eye comes to rest. In some cases, there is no object at the focal point; rather the eye naturally rests at a point in the distance.

Emphasis can be added to a focal point by establishing lines that draw the eye to it. Emphasis can be created by framing the view with vegetation. The view can also be enhanced by reducing clutter or removing distractions such as overhead power lines, signs or vegetation from the field of vision.



Breaks in the tree line allow views like this one from Highway 421 in Shady Valley, Tennessee

Before



Selectively clearing vegetation can open and frame a view



After



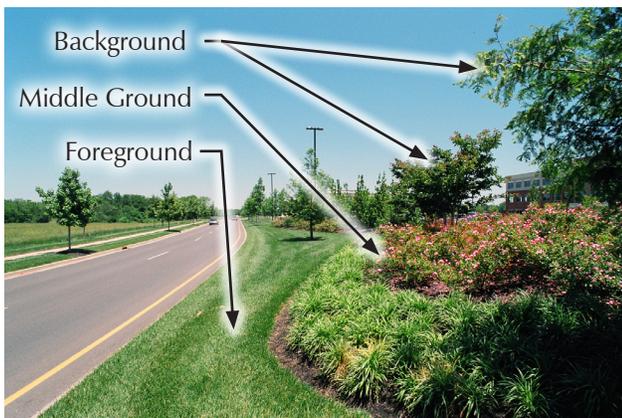
Use grasses or other low-growing vegetation to preserve views, like this interchange at exit 50 on Interstate 81 in Washington County



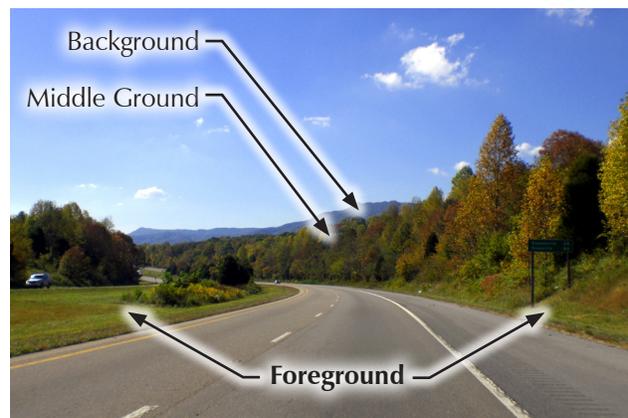
Depth can be created by using a variety of flowers, ground covers, ornamental grasses, shrubs and trees of different heights

Depth

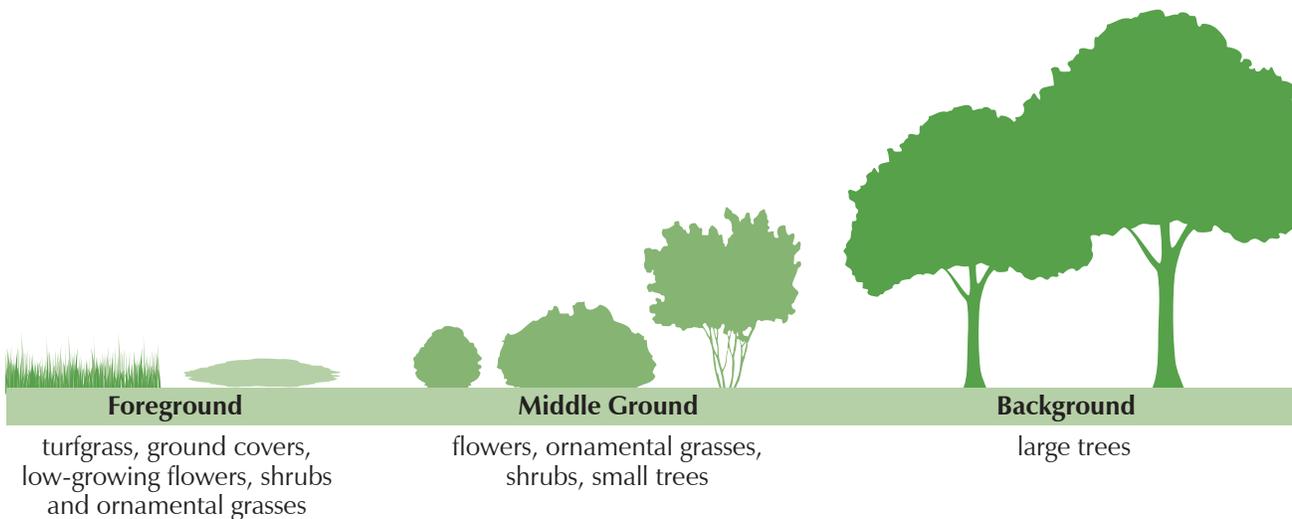
Depth is established by defining a clear *foreground*, *middle ground* and *background*. Foreground refers to the objects closest to the viewer. At a smaller scale, this is typically low-growing vegetation like turfgrass, flowers or ground covers. Middle ground refers to the objects behind the foreground; flowers or shrubs usually compose the middle ground. Background is furthest from the viewer and provides a backdrop to the foreground and middle ground. Trees usually compose the background of small scale plantings, whereas city skylines or mountains may compose the background in the broader context.



Depth at small scale



Depth at large scale



LANDSCAPE MATERIALS

Landscape materials include more than trees, shrubs, flowers and mulch. This section expands upon this typical image of landscape materials to include all materials that add to the composition of the landscape, including hardscape materials like stone, concrete, masonry, metal and wood.

Material selection depends on the site's conditions and the context of the surroundings. Vegetation selection is dependent on environmental conditions such as the region of the state, plant hardiness zones, light exposure and water requirements, as well as other site-specific conditions such as available space, utilities and roadway safety requirements. Hardscape material selection is influenced by existing natural and structural features and safety requirements. Material selection is also dependent upon cost and availability.

Vegetation

Six general categories of vegetation are discussed in this section: trees, shrubs, ground covers, vines, grasses and flowers. Each type of plant has physical attributes that contribute to different visual qualities of the landscape such as form, color, height and seasonal interest.

Trees

Trees come in a variety of shapes and sizes, ranging from 10 to more than 100 feet in height and/or spread. Trees can be deciduous or evergreen and have other qualities such as showy flowers or exceptional fall color. Trees provide numerous environmental and aesthetic benefits, including water uptake and filtration, wildlife habitat, cleaner air and climate control. Aesthetically, trees introduce human scale to manmade landscapes, visually soften straight lines and hardscape, add texture with light and shadow, define spaces, accent or screen views, and add seasonal interest.

The placement of trees in the roadside environment can be somewhat limited due to safety concerns but trees are major assets when the right tree is used in the right place. Some roadside tree plantings are constrained by sidewalks, roads, utilities and buildings. Trees require adequate space for root and crown growth to promote their long-term health and survival. Poor conditions will stunt a tree's growth and increase the risk of disease or death. These issues underscore the importance of choosing the right tree for the right place.

QUICK FACTS

A mature bald cypress can absorb 880 gallons [of water] per day, depending on the soil type and saturation.

Recommended Trees for Stormwater Uptake

Red Maple
(*Acer rubrum*)

Serviceberry
(*Amelanchier arborea*)

River Birch
(*Betula nigra*)

Sweetgum
(*Liquidambar styraciflua*)

Tulip Poplar
(*Liriodendron tulipifera*)

Sycamore
(*Platanus occidentalis*)

Swamp White Oak
(*Quercus bicolor*)

Pin Oak
(*Quercus palustris*)

Red Oak
(*Quercus rubra*)

Willow
(*Salix sp.*)

Bald Cypress
(*Taxodium distichum*)

Source: Keating, "Trees: The Oldest New Thing in Stormwater Treatment?"

QUICK FACTS

Several shrub species have fall and winter interest, including showy flowers, berries, attractive foliage or colorful stems.

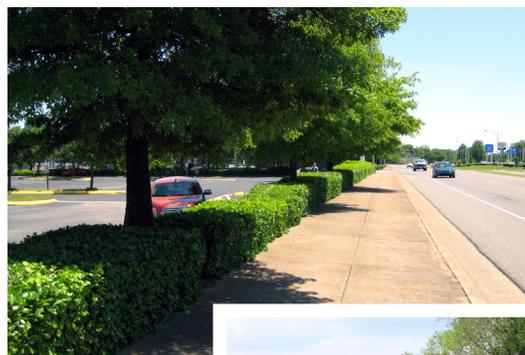
	Ornamental Quality in Fall/Winter			
	Flowers	Berries	Foliage	Stems
Wintersweet (<i>Chiomonanthus praecox</i>)	●			
Tatarian Dogwood (<i>Cornus alba</i>)				●
Redosier Dogwood (<i>Cornus sericea</i>)				●
Forsythia (<i>Forsythia x intermedia</i>)	●			
Dwarf Fothergilla (<i>Fothergilla gardenia</i>)			●	
Witch Hazel (<i>Hamamelis x intermedia</i>)			●	
Oakleaf Hydrangea (<i>Hydrangea quercifolia</i>)			●	●
Inkberry (<i>Ilex glabra</i>)			●	
Winterberry (<i>Ilex verticillata</i>)		●		
Blue Holly (<i>Ilex x meserveae</i>)		●	●	
Virginia Sweetspire (<i>Itea virginica</i>)			●	
Winter Jasmine (<i>Jasminum nudiflorum</i>)	●			
Andorra Juniper (<i>Juniperus horizontalis</i> 'Plumosa Compacta')			●	
Firethorn (<i>Pyracantha coccinea</i>)		●		
Gro-low Fragrant Sumac (<i>Rhus aromatica</i> 'Gro-low')			●	

Shrubs

Shrubs come in a range of shapes and sizes, can be evergreen or deciduous, have ornamental value, and are incredibly versatile. Shrubs can be used to define edges or separate the roadway from other large expanses of hardscape such as parking areas and building facades. Shrubs visually soften hardscape and screen utilities. Low-growing and spreading shrub species, like some junipers, provide erosion prevention when planted on steep slopes. Furthermore, shrubs can help create an open feel by emphasizing the extent of a landscape by allowing open views.

Shrubs provide changing seasonal interest, especially when used in mass. Many shrubs flower in the spring or summer, provide fall color and retain berries throughout the winter. Planting masses of shrubs instead of turfgrass will reduce the need for mowing. Such shrub masses require some maintenance during establishment to prevent weed growth but will require less maintenance over time.

Shrubs' smaller size allows for more versatility in planting locations, but sight line requirements should be considered when selecting which species to use. In these areas, choose shrubs with a natural habit of less than 2 feet in height. Otherwise, shrubs in clear sight windows (Figures 1.4 through 1.6) must be maintained to a maximum of 2 feet in height to keep sight lines open.



Evergreen shrubs are effective as hedges, whether to block the view to a parking lot (left) or for privacy from the roadway (right)

Ground Covers

Ground covers are low-growing, spreading plants. Depending on the species used, ground covers can be spreading or upright, evergreen or deciduous, and range in height from 6 to 12 inches (Booth). Many shrubs and vines are used for ground cover because they exhibit these characteristics. Ground covers can be used to define the edge of planting areas, on steep slopes, in large masses and in areas where reduced mowing is desired. Aesthetic benefits include creating a uniform foreground, covering unattractive areas and creating large masses of color. Ground covers can be used in place mulch and are effective methods of erosion prevention and weed control.

Though they are adept at erosion prevention, many commonly used ground covers have been designated as invasive or noxious species. This is an issue because the plant spreads into surrounding natural areas and competes with native vegetation. Some ground covers will climb nearby trees and shrubs creating a landscape that looks unkempt but also starving the trees and shrubs of light and nutrients. In areas where such spreading is a concern, shrubs with a low, spreading habit are often a better option.



A variety of ground covers can provide visual and seasonal interest, like this median which showcases daylilies, St. John's Wort, liriopse and creeping juniper



Spreading shrubs, like these Cherokee roses, are an excellent ground cover for slopes and areas that are inaccessible to maintenance equipment

Vines

Vines are climbing plants that attach to vertical elements (e.g., walls, trellises, cables, other vegetation, etc.) by twining around an object or attaching to an object with clinging roots or tendrils. In the absence of a vertical element to climb, vines will trail along the ground and can be used as a ground cover. Vines can be used to cover unattractive features, for fall color, flower or berry displays, in areas where there is limited horizontal space, to break up the monotony of long expanses of walls or fences, or to stabilize steep slopes.

As noted with ground covers, some vines can become invasive and should be used with caution.

Grasses

Three types of grasses are common in the roadside environment: turfgrass, ornamental grass and native grass.

Turfgrass

Most of the existing roadside landscape throughout Tennessee is turfgrass that was planted for erosion prevention purposes after initial construction. Turf is used extensively because of its durability, fast growth and tolerance of adverse conditions. It requires frequent mowing and will compete with native species.



Mowed turfgrass beneath large trees creates a park-like setting

Ornamental Grass

Ornamental grasses are used in the landscape as accent plants or in masses. They have distinct form and texture, and their height can range from a few inches to several feet tall. Most ornamental grasses are clump forming and offer year-round interest.

In recent years, ornamental grasses have become common in landscapes. Most ornamental grasses are non-native and some species can be invasive. They are ideal for use in urban and suburban settings and are frequently found in streetscapes or as accents to gateway features. They are low maintenance and require an annual cutting in early spring before the new growth comes out. This will allow the grasses to provide visual interest throughout the winter. Overall, ornamental grasses are effective for a low cost, low maintenance landscape that will make a big impression.



These ornamental grasses provide great contrast (color and texture) to the landscape

Few physical constraints exist for the placement of ornamental grass. Most ornamental grass species can tolerate many of the same constrained spaces as shrubs, but some exhibit spreading qualities that can be difficult to control in areas without defined boundaries.

Native Grass

The use of native grasses in roadside environments has gained increased attention and study in recent years. Countless environmental and financial payoffs can be achieved by converting land that is currently mowed into native plantings that only require annual mowing. Native grasses can be used in areas where the use of trees and shrubs is limited, such as clear zones. Those that do not exceed height requirements can be planted in areas that require clear sight lines.

Large areas of native grasses are aesthetically suited to suburban and rural settings. Most are naturally adapted to flat areas, but extensive root systems also make them ideal for stabilizing moderate slopes. Large planting areas are most effective at achieving environmental and aesthetic benefits.

The cultivation and establishment of native grasses is very important. A poorly established stand of native grass from seed can be misinterpreted by the public as a weedy area. Once established, the key to maintaining attractive native grass plantings is to keep a regularly mowed edge and to prevent woody species from encroaching by mowing annually. Keeping the outer edge mowed creates a clean line and influences a more positive public response. The edge of native grass plots should follow the existing land form to create a more natural appearance.



Bold flower colors add a burst of color to planting beds



Flowers can be appreciated along the interstate when planted in large masses, like these daylilies at an interstate interchange

Flowers

Flowers are an excellent way to provide color and seasonal interest. In the roadside environment, their primary function is to accent a landscape, but they can also define borders and edges, and offer year-round interest. With a wide range of bloom dates, a single planting bed could have flowers that bloom from late winter to late fall. Flowers can be started from seeds or bulbs, or come in containers.

Flowers are generally described as being annual or perennial; however, this can vary depending on growing conditions (i.e., a flower that is an annual in Tennessee may be perennial in Florida). The plant lists provided in Appendix indicate where a flower is an annual or perennial based on how it grows in Tennessee.

Annuals have a life cycle that lasts one year and will need to be removed and replaced yearly; however, depending on the species, some annuals may reseed themselves. Annuals are a great way to add a splash of seasonal color and are often used in planters, hanging baskets and small landscape beds.

Perennials return year after year, often growing each year until they reach their mature size. Some perennials retain their leaves throughout the year, but others die back and reappear the following year from the same root system. Unlike annuals, they do not need to be replaced each year, but some may lose their appeal after a few years and need to be replaced.

Both native (e.g., black-eyed Susan, purple coneflower) and non-native flowers (e.g., tulips, daylilies, daffodils) are found in the roadside environment. Flowers are often used at gateways, rest areas and welcome centers, and in planting beds along the right-of-way. Along Tennessee's interstates, they have also been planted in large masses in interchanges and medians and on the slopes at bridge overpasses.

Wildflowers

Wildflowers, both native and non-native, are present throughout the roadside environment, mostly within large plots along the highway right-of-way, in medians and at interchanges. As part of the Tennessee Wildflower Program, TDOT plants a combination of perennial and annual plants, including blanket flower, black-eyed Susan, cosmos and red corn poppy. They are best appreciated when planted in large plots, no less than 1/4 acre, in highly visible areas. Wildflowers should be used in combination with native

grasses to provide a uniform appearance to planting areas when they are not in bloom.

Wildflowers are especially popular among residents and tourists alike. The statewide survey results and public input meetings consistently ranked wildflowers as one of the preferred landscape types (Shelton).



Wildflowers at the Interstate 55 Welcome Center in Shelby County, Tennessee

Choosing the Proper Vegetation: Right Plant – Right Place

The first step in choosing plants is to determine their desired function. The function can be aesthetic (focal point, splash of color, etc.), practical (screening, erosion prevention, wind break, shade, etc.) or both. Once the function of the plant has been determined, the next items to consider are environmental conditions, plant size and maintenance. Use the information gathered in the site inventory and analysis phase, which documents both environmental and built conditions, to determine what plants will thrive versus those that may struggle to establish or die.

Environmental Conditions

Most important to the selection of roadside plants is their ability to thrive in the harsh conditions of the roadside environment. Plants in the roadside must withstand high temperatures, salt spray, poor soils and drought. Environmental conditions, including hardiness zone, light exposure, soil moisture and composition, slope and existing vegetation, must be considered. They are the most important factors in determining a plant's long-term health and performance.

The plant lists in the Appendix are provided to make the task of choosing plants easier. They are organized by plant type and indicate each plant's preferred growing conditions. Several options for urban-tolerant plants, which are plants most adapted to harsh growing conditions, have been provided. Several native plants have been included in the list by region of the state (East, Middle and West). Roadside enhancement projects are not limited to the plants found in these lists, but they provide a wide variety of species that have performed well in the roadside environment.

Plant Size

A plant's mature height, spread and form are important aspects for plant selection and will determine whether it will fit into the available planting space. For example, columnar forms can be planted in narrow corridors where space is limited. Vase-shaped trees can be effective at screening objects above eye level but are open at the sidewalk and roadway level if their lower branches are kept trimmed.

Consider plant size when designing under or adjacent to overhead power lines. As the tree grows it must have enough space away from power lines to accommodate its canopy. Planting trees too close to power lines or planting trees that are too large for the area will eventually require pruning or total tree removal to keep branches away from the wires. Pruning affects the aesthetics of the tree and the overall landscape and can compromise the tree's health and structural integrity. The plant lists provided in the Appendix include species that are acceptable for planting under power lines. Tall shrubs can often be substituted in areas where trees may interfere with overhead power lines.

While it is important to consider how well a plant will fit above the ground, space for a plant's root system is even more important. A plant's root system, especially trees, can be quite extensive. In roadside environments, root systems have to share space with underground utilities and pavement (e.g., curbs, sidewalks, roadways). Depending on the plant, the root system can be damaged by these structures or, conversely, the roots will do the damage. For this reason, avoid planting trees directly above or within 15 feet of underground utilities. Shrubs, ground covers and other plants with less extensive root systems are acceptable near underground utilities.

In urban streetscapes, trees are often placed in the sidewalk. An adequate volume of soil and the soil's composition is key to ensuring a tree's survival in such an environment.



The height (top) and spread (bottom) of the trees in these photos were too large for these locations and branches were trimmed to prevent interference with power lines

Chapter 5, *Installation and Maintenance*, provides details and information for street tree plantings.

Maintenance

Some plants require higher levels of maintenance than others if they are susceptible to certain pests or disease, produce litter (e.g., leaves, fruit), require frequent pruning, or are sensitive to changes in growing conditions. Maintenance resources should be considered if plants require a higher level of maintenance. This is especially important in the urban environment where plants are usually pruned and tended more often. Plant litter on sidewalks or roadways may become a hazard or nuisance in urban streetscapes but is less of a concern along vegetated rights-of-way with no pedestrian traffic.

Other Considerations

Certain regulations should also be considered when choosing plants. The Americans with Disabilities Act (ADA) requires tree branches to be kept 8 feet clear from the walking surface (see Figure 5.7). Depending on the municipality, there may also be requirements for setbacks or planting around utilities. Many municipalities also have approved plant lists and rules about the use of native, non-native or exotic plant species. Such requirements can be determined by contacting the municipality and should be researched prior to selecting plant material.

Native Vegetation

Native vegetation, especially those that are tolerant to drought, pests and disease, should be used as much as possible. Native plants require less overall maintenance and are generally self-sustaining when planted in proper growing conditions and installed correctly. Some other benefits of planting natives include:

- Reduction of weed and other noxious plant growth
- Reduction of chemical applications (e.g., fertilizers, herbicides, fungicides, insecticides)
- Water conservation
- Wildlife habitat

A common misconception is that native plants are not as appealing as non-native plants. They are often associated with natural environments that are much less orderly than a residential, commercial or more formal landscape. However, many plants found in nurseries are native plants. With proper selection and selective placement of native plants, even formal landscapes can be achieved with natives.

QUICK FACTS

There are several native plants that can easily be substituted for commonly used non-native plants.

Common Non-native Plants	Native Plant Alternatives
Bradford Pear (<i>Pyrus calleryana</i>)	Serviceberry (<i>Amelanchier arborea</i>) Redbud (<i>Cercis canadensis</i>) Dogwood (<i>Cornus florida</i>)
Burning Bush (<i>Euonymus alata</i>)	Virginia Sweetspire (<i>Itea virginica</i>) Fragrant Sumac (<i>Rhus aromatica</i>)
California Poppy (<i>Eschscholzia californica</i>)	Sundrops (<i>Oenothera fruiticosa</i>) Butterflyweed (<i>Asclepias tuberosa</i>)
English Ivy (<i>Hedera helix</i>)	Woodvamp (<i>Decumaria barbara</i>) Allegheny Spurge (<i>Pachysandra procumbens</i>) Crossvine (<i>Bignonia capreolata</i>)
Japanese Barberry (<i>Berberis thunbergii</i>)	Ninebark (<i>Physocarpus opulifolius</i>) Dwarf Fothergilla (<i>Fothergilla gardenii</i>) Winterberry (<i>Ilex verticillata</i>)
Periwinkle (<i>Vinca minor</i>)	Phlox (<i>Phlox divaricata</i>) Creeping Phlox (<i>Phlox stolonifera</i>)
Wintercreeper (<i>Euonymus fortunei</i>)	Crossvine (<i>Bignonia capreolata</i>) Pussytoes (<i>Antennaria plantaginifolia</i>) Green and Gold (<i>Chrysogonum virginianum</i>)

Source: Tennessee Exotic Pest Plant Council (TN-EPPC), www.tneppc.org

Although the commercial demand for native plants is increasing, availability can be limited. The native plant industry is growing in Tennessee and across the country. Large quantities of native seeds and plants should be coordinated with nurseries and native plant growers to ensure availability and uniformity.

It is always important to consider the existing roadside conditions when choosing plant materials, particularly natives. There are times when road construction activities create environments where plants, though native to the project area, may not be suitable (e.g., steep slopes, altered soil composition). In these instances, it is important to employ the right plant-right place concept by choosing plants that will thrive under the *current* roadside conditions.

Hardscape

When selecting hardscape materials and their placement in the roadside environment, existing design criteria, such as clear zones, must be considered. The TDOT Design Division can provide further site-specific guidance on hardscape materials.

Brick

Brick is a classic construction material best used for detailed work and is most practical in urban areas and streetscapes. Since many patterns and colors of brick and grout are available, its use can create a refined design style to the roadside landscape in all landscape classifications. Brick is widely available and ideal in places where detail can be appreciated, such as low speed roadways and pedestrian areas.



Brick can be used for horizontal (left) or vertical surfaces and is an attractive material for structures (right)

Modular Block

Modular block is a popular construction material because of its availability and ease of installation. Most products are manufactured to provide structural integrity without mortar. It is often used for segmental retaining walls but is also used to construct planting beds, seat walls and other structures. Many colors, textures and block sizes are available. Using combinations of colors can personalize streetscapes and add interest to long expanses of wall.

Large walls and long spans of uniform modular block can appear monotonous or overpowering and should be avoided when possible. Reducing the size of the wall to the extent possible can limit its visual impact. Introducing form or color changes can also reduce the negative visual effects of too much hardscape. If a wall's height cannot be reduced, consider terraces for planting areas or vegetative screens to soften the hard lines of the material.



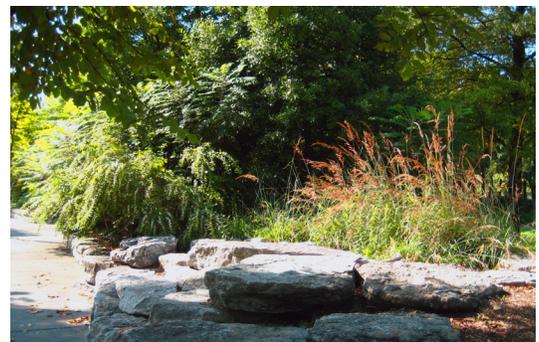
Modular block can be made to resemble real stone by using various textures and color additives

Stone

Stone, in its natural form, is a common feature along Tennessee roadsides as a result of road cuts and natural stone outcrops. Stone type is varied throughout Tennessee and no shortage of the material exists in the natural landscape. Limestone, sandstone, chert, shale and slate are only a few of the common rock types found throughout the state. Not all types are suitable for use in construction, but their physical qualities can be used for design ideas in order to create a context sensitive design.

Stone, when used as a building material, comes from quarries and is often used for walls or walkways. It can also be used as an accent or feature in landscape beds, such as a boulder surrounded by plantings. In historic and scenic districts, stone may be an appropriate material choice if it exists in surrounding structures. Stone also has qualities that complement natural and rural environments and create a naturalistic appearance.

When used as a building material, stone requires the use of mortar and reinforcements, resulting in a more labor and time intensive process that increases cost. Stone is an attractive design feature, even in small quantities, so slightly higher costs can be accounted for by using it in only the most visible areas. Non-structural stone walls or artificial stone veneers (see *Concrete*) can be lower in cost than real stone and have the same visual appeal. In general, using stone that is quarried or produced near a project site will keep its cost lower and fit the regional context.



Boulders are an attractive accent in planting beds and complement naturalistic landscapes



Boulders were used in this design to accent and delineate a walkway while smaller stones were set in the concrete as additional accents



Manmade walls are integrated into exposed limestone using stone with similar characteristics

Stone choice is both regionally and site specific since color and form can vary greatly from region to region. When choosing stone for a landscape project, consider its color, size, shape, durability and availability. Approach the decision by examining the surrounding landscape. If stone is present, observe its color, pattern and form. After analyzing the existing materials, decide if repeating the existing patterns and material is the best option for the project. For the most visually sensitive approach, repeat the color, pattern and form of existing stone in surrounding structures, such as bridge abutments and retaining walls, especially if they are built adjacent to exposed rock.

Concrete

Concrete is the most common construction material used in roadside structures. It is the most cost effective and durable solution available for building retaining walls, bridge abutments and noise barriers.

Unfinished concrete may not be the most aesthetically pleasing material for structures, but a variety of treatments can be implemented to improve its appearance. Concrete finishes are highly varied and economical. Color and surface textures can be applied to any new concrete construction, and a range of techniques is available for improving the appearance of existing concrete.

Exposed Aggregate

Exposed aggregate surfaces are achieved by washing away the outer layer of cement to uncover the coarse aggregate. This method can be used on both vertical surfaces (e.g., walls, facades) and horizontal surfaces (e.g., plazas, sidewalks). A variety of aggregate types, colors and sizes are available as additives to concrete.



Exposed aggregate has random patterns and various colors that create an appealing texture and contrast well with smooth concrete finishes





Natchez Trace Parkway bridge with engraved concrete

Concrete Engraving and Stenciling

Concrete engraving and stenciling is the process of using saw-cuts to add text, graphic logos and decorative borders to unfinished concrete. This technique can achieve big results in small areas and be combined with color applications. It can be applied to vertical and horizontal surfaces.

Stamped Concrete

Virtually any pattern can be applied to vertical and horizontal concrete surfaces with stamps or molds. Stamped concrete is an economical solution that is used to add texture and patterns to crosswalks, sidewalks, retaining walls, abutments and noise barriers. In some cases, concrete can be stamped to match existing masonry walls and exposed rock.

Vertical surfaces (e.g., walls, abutments) are more visible to motorists, whereas pedestrians are more aware of horizontal surfaces (e.g., sidewalks). The level of detail in which a passing motorist can view any surface is limited by the speed they are traveling, but texture of any kind can add visual interest to a structure. Regardless of the audience, stamped concrete is a simple, cost effective and aesthetic technique.



Stamped concrete can be used on horizontal surfaces (top), vertical surfaces (bottom)

Metal

Steel

Steel is the primary visual component in guardrails, fences and bridges. Its aesthetic treatments are generally limited to paint or vinyl coating. Weathering steel is a type of steel alloy that does not require painting and will develop a rust-like appearance over time. Weathering steel creates an accepted aesthetic in some historic and scenic districts because its rust color tends to blend into the surrounding landscape. It is popular near historic industrial and railroad sites and within modern developments, often as a way to contrast old-looking material with new urban areas.



Weathering steel, like this pedestrian bridge in Lebanon, Tennessee, complements the natural environment

Cable

Cable is currently used in guardrails along portions of Tennessee's roadway, but must be kept clear of vegetation. Another use for cable is in trellises, particularly in streetscape environments. Cable trellises can support climbing vines, which wrap or twine around objects rather than sticking to them with roots. These trellises, commonly called living walls, allow climbing vines to grow vertically. This increases the number of potentially usable plants for areas where growing space is at a minimum. In addition to providing aesthetic benefit, living walls can reduce microclimate



Metal lettering used at an Interstate 40 interchange feature in Knoxville, Tennessee



Wood fence at Stones River National Battlefield in Murfreesboro, Tennessee

temperatures and glare by shading surfaces that absorb heat. These systems are most appropriate for urban landscapes where growing area is limited. For example, a cable trellis system could be installed on a building wall with a narrow planting strip at the base.

Wood

Wood can be used in signs, sign posts, bollards and a number of other structures in the roadside, but it is best used in environments where its aesthetic benefits can be appreciated. For all of its strength and durability, wood displays a context sensitive aesthetic. It is often used along scenic roadsides and historic districts to coordinate with common architectural materials.

LANDSCAPE COMPOSITION

The following guidelines will provide a process for applying the building blocks and materials to landscape design on various roadside environments from small to large scale. The guidelines provide practical information about composition and appropriate designs for various locations and site conditions. Three general design approaches, ornamental, naturalistic and monoculture, are also discussed.

Guidelines for Designing with Plants

Determine Planting Area

Planting areas should be highly visible to motorists and/or pedestrians. To select areas along rights-of-way, consider the land visible to the motorist, such as slopes facing the roadway. In topographically flat landscapes with little variety in scenery or vegetation, create interest with planting beds placed at intervals, selective clearing and mowing patterns. Include areas that are difficult to manage (e.g., steep slopes, wet soils, etc.) and incorporate existing vegetation into the design. Unique site conditions usually result in unique design solutions.

After selecting the site, determine the dimensions of the planting area. As a general guideline, include at least one third (1/3) of the overall planting area, as described in *Scale and Proportion*. A scaled base map or GPS (global positioning system) will provide square footage and acreage. This dimension will influence your choice of materials. The area should be large enough to accommodate the plants that are desired and plants should be selected to be proportional to the allowable space.

In general, the mature height of the tallest plant should relate to the width of the planting area, preferably in a 3:1 or 3:2 ratio. For example, if small trees with a height of 20 feet are the tallest plant in a planting bed, the defined planting area should be at least 60 feet wide. This same concept and ratio guideline applies when planting masses of shrubs, ground covers or flowers. The size of the planting mass should respond to the overall area.

Determine Planting Bed Shape

Define the edge of the planting area applying the principles of *line* and *form*. The shape of the planting bed will depend on the landscape classification, context and the desired effect (e.g., straight lines and geometric shapes are typically associated with urban areas). It is best to keep planting areas and vegetation management areas contiguous with minimal breaks or gaps between planting beds. When designing more than one planting bed in an area, leave adequate space between beds (approximately 15 feet) to accommodate mowing equipment.

If there is existing vegetation, incorporate it into the planting bed. Existing vegetation and the site's natural topography are the best way to establish the planting edge.

Plant Variety and Quantity

A variety of plant species can create a more visually interesting landscape. Various plant heights, spreads, colors, textures and forms can combine to create an attractive design; however, the roadway travel speed and the size of the plant bed should be considered when choosing the number of plant species per planting area. Too much variety in a small planting area can appear cluttered or busy. Conversely, too little variety of species in a large area can be dull or unappealing.

Because detail is visible from a stopped or slow-moving vehicle, a greater number of species can be effective. At high speeds, too many plant species, particularly in ornamental plantings, can become distracting unless they are in a naturalizing environment. Fewer varieties of plants are more effective along high-speed roadways.

The design approaches discussed in the following pages provide recommendations for the number of plant species to use depending on the design approach and the size of the area to be planted.

Design Approach

Plant selection and placement within a composition will depend on the context, desired aesthetic effect and size of the area to be planted. Three general design approaches that cover the best options for roadway landscapes have been identified: ornamental, naturalistic and monoculture.

Table 4.1 provides suggestions for the design approach that is most appropriate for a site based on the landscape classification and landscape type.

Table 4.1: Suggested Design Approach by Classification and Landscape Type

Urban Classification

Design Approach	Scale	Landscape Type						
		Interchanges	Rights-of-Way (including medians)	Intersections	Rest Areas/Welcome Centers	Scenic Roadways	Gateways	Streetscape
Ornamental	Large (1/8 - 1/4 acre)	•	•	•	•		•	•
	Small (≤1/8 acre)			•	•	•	•	•
Naturalistic	Large (>2 acres)		•		•	•		•
	Small (≤2 acres)		•		•	•	•	•
Monoculture	Large (>2 acres)	•	•		•	•	•	•
	Small (≤2 acres)	•	•	•	•	•	•	•

Suburban Classification

Design Approach	Scale	Landscape Type						
		Interchanges	Rights-of-Way (including medians)	Intersections	Rest Areas/Welcome Centers	Scenic Roadways	Gateways	Streetscape
Ornamental	Large (1/8 - 1/4 acre)	•	•	•	•		•	•
	Small (≤1/8 acre)		•	•	•	•	•	•
Naturalistic	Large (>2 acres)	•	•	•	•	•	•	•
	Small (≤2 acres)	•	•	•	•	•	•	•
Monoculture	Large (>2 acres)	•	•	•	•	•	•	•
	Small (≤2 acres)	•	•	•	•	•	•	•

Table 4.1: Suggested Design Approach by Classification and Landscape Type (continued)

		Rural Classification						
Design Approach	Scale	Landscape Type						
		Interchanges	Rights-of-Way (including medians)	Intersections	Rest Areas/ Welcome Centers	Scenic Roadways	Gateways	Streetscape
Ornamental	Large (1/8 - 1/4 acre)				•		•	•
	Small (≤1/8 acre)			•	•		•	•
Naturalistic	Large (>2 acres)	•	•	•	•	•	•	
	Small (≤2 acres)	•	•	•	•	•	•	•
Monoculture	Large (>2 acres)				•			
	Small (≤2 acres)	•	•	•	•	•	•	•

		Community Classification						
Design Approach	Scale	Landscape Type						
		Interchanges	Rights-of-Way (including medians)	Intersections	Rest Areas/ Welcome Centers	Scenic Roadways	Gateways	Streetscape
Ornamental	Large (1/8 - 1/4 acre)	•	•	•	•	•	•	•
	Small (≤1/8 acre)			•	•	•	•	•
Naturalistic	Large (>2 acres)	•	•	•	•	•	•	•
	Small (≤2 acres)	•	•	•	•	•	•	•
Monoculture	Large (>2 acres)	•	•	•	•	•	•	•
	Small (≤2 acres)	•	•	•	•	•	•	•

Ornamental Plantings

Ornamental plantings are characterized by a highly ordered arrangement of plants that serve as focal points. Ornamental plantings fit into the highly structured character of certain environments, such as office park entry features and urban streetscapes. Plants used in ornamental landscape beds have distinct form and characteristics. A combination of plants and materials that contrast and complement one another can increase the ornamental qualities of a design.

Ornamental plantings require a higher level of maintenance, so they are not recommended for all roadside landscapes. These plantings must be regularly maintained as they will not blend into the landscape at the end of their lifecycle; long-term maintenance and replacement of plant material must be considered.

Small Scale

Small planting beds are most appropriate for low-speed roadways and areas with pedestrian traffic. Limit the number of plant species to five in planting beds or areas of less than one eighth (1/8) of an acre. Create a background with one or two larger plants, such as small ornamental trees or shrubs. Use smaller shrubs or perennials for the middle ground and one species of flowers, turfgrass or low-growing ground cover for the foreground.



This small scale ornamental planting in downtown Nashville, Tennessee, makes a bold impression with ornamental grasses and brightly colored annuals, which are replaced throughout the year



Large Scale

Limit the number of plant species to three or use a larger mix of species with similar visual qualities (i.e., height, color, texture, form). Use one large plant species to create the background and one or two smaller plant species for the middle ground. Create a foreground with a turfgrass or low-growing evergreen ground cover. Use plants with contrasting visual qualities to achieve dramatic effects, or use plants with similar qualities to achieve a clean aesthetic.

Naturalistic Plantings

Naturalistic plantings are appropriate for all landscape classifications and are effective in areas where a moderate amount of order enhances the existing natural and human environment. Creating a natural-looking planting from the ground up is not an easy task. Naturalistic plantings can be achieved by planting new vegetation, allowing areas to revegetate, selectively clearing existing vegetation or any combination of these methods. Choosing the correct type and variety of plant species is the key to creating a naturalistic landscape.

Allowing previously mowed rights-of-way to revegetate naturally can be accompanied by some level of mechanical and/or chemical control to facilitate the growth of desirable species until the planting area is self-sustaining. Management methods are described in Chapter 5, but plant selection is a matter of applying the building blocks of design. Promote the growth of taller vegetation furthest from the viewer to create depth. Facilitate the growth of groupings of plant species to create an implied line between species and masses of color and texture; supplemental planting may be necessary to achieve these effects. The amount of intervention that takes place will have a direct result on the planting area's level of naturalism.

Selective clearing and supplementing with native vegetation is an approach to naturalistic landscapes that requires little cost but improves aesthetics dramatically. The concept of this process is to simplify an existing landscape by selectively removing vegetation to create depth, line, texture and other qualities that may otherwise be missing. It will require flexibility and foresight as the environment changes yearly. First, consider the health of each species within the existing plant community and promote those that are thriving. Next, evaluate the mature height and spread of the existing trees and their distance from the roadway to determine if they should be removed to prevent future safety hazards. Finally, consider the mature plant size and determine a hierarchy

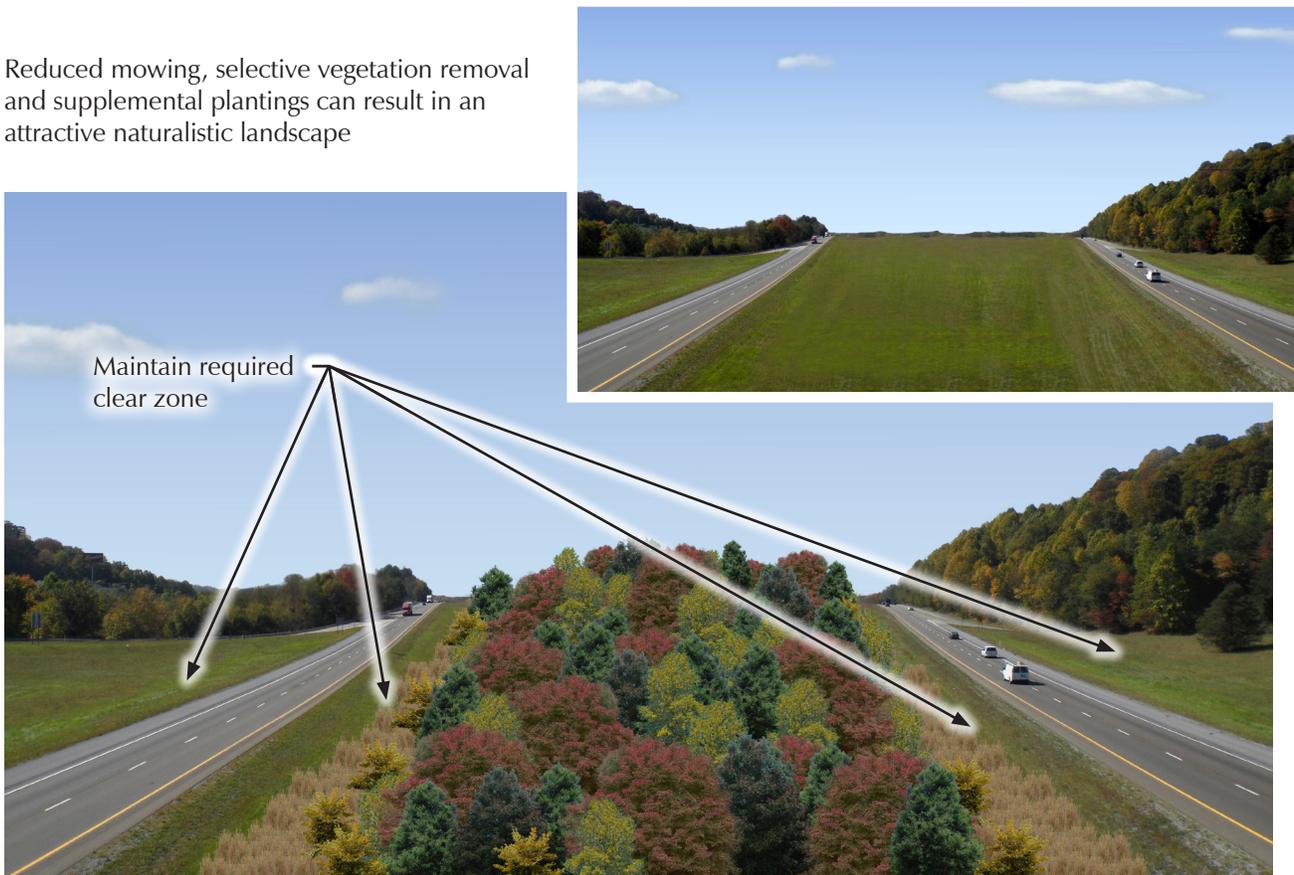
(i.e., background, middle ground and foreground) and create masses of color or texture by either removing or adding plant material.

Regardless of which approach is used to create a naturalistic planting, the goal remains to reduce long-term maintenance without sacrificing aesthetics. If executed correctly, short-term planting and maintenance techniques should result in vegetated areas that require little long-term maintenance and will not interfere with the function or safety of the roadway.

Small Scale

When installing new plant material, select one to two large plant species to compose the background and one or two smaller plant species for the middle ground. For areas with existing vegetation, remove invasive and unhealthy plants and leave healthy plant material in place for the background and middle ground. Supplement existing vegetation by installing similar species to fill in spaces and create masses. The various plant species should be spaced with consideration for their mature size. Create a foreground

Reduced mowing, selective vegetation removal and supplemental plantings can result in an attractive naturalistic landscape



with a single species or mix of species with similar heights and textures. Native grasses and turfgrass are excellent foreground plant materials.

Large Scale

The same basic guidelines for a small scale naturalistic planting apply to the large scale as well. The most environmentally beneficial and passive approach to vegetation management is to promote large scale, existing plant communities and to supplement with new plantings when necessary. This process allows the growth of many species through minimal intervention of natural systems. Limit species removal based on the health, mature size and proximity of the vegetation to the roadway.

Monoculture Plantings

Monoculture plantings are characterized by a uniform appearance created by using a single plant species. Monocultures can be applied in all classifications and area appropriate for all landscape types.

To be considered a monoculture, multiple plants of the same species are planted in mass. Planting a mass of the same plant species will create a uniform appearance that can simplify complex landscapes. Monocultures of spreading shrubs and ground covers can also be an effective form of weed and erosion prevention since landscaped slopes do not need mowing, and unwanted plants are easy to spot and remove.

To implement a monoculture, choose a plant species that thrives in the site conditions since unhealthy or dying plants are more noticeable in a monoculture and can have undesirable visual effects. Choose plants that have qualities that are more effective at achieving a desired aesthetic or environmental benefit. For instance, in contained areas such as medians or interchange islands, a monoculture of daylilies can prevent erosion while providing seasonal color in a highly visible area.

Weeds and dying plants are very noticeable in monoculture plantings but are easier to remove at their first sign because of their visibility. Regular chemical applications and/or weeding may be necessary in the first few years to remove weeds, but long-term maintenance is minimal since the plants will crowd out weeds and block the sunlight needed for weeds to grow. Each vegetation type will require a different level and type of maintenance and create a unique aesthetic.

A brief summary of expected maintenance requirements and the aesthetic effect of monocultures include:

- *Tree Monoculture*

Mowing and weed-trimming beneath the tree canopy and around trunks will create a park-like setting. Maintenance requirements are high because weeds must be kept away from trunks. Use a ground cover or mulch beneath trees to reduce mowing and maintenance.



Tree monocultures, like these tulip poplars, are commonly used to line roadways

- *Shrub and Ground Cover Monoculture*

Evergreen shrubs, such as spreading juniper, create year-round interest and have formal qualities. Deciduous and colonizing shrubs, such as red twig dogwood, that spread by their root systems can provide a variety of year-round interest from flowers to fall color to berries. They do well at holding slopes and offer a softer, more informal aesthetic than most evergreens.

- *Turfgrass*

Turf is the most common roadside monoculture, mainly chosen for its erosion prevention abilities and tolerance for harsh roadside conditions. It must be regularly maintained and treated to prevent weeds and woody plant species from establishing. Mowed turfgrass creates a clean aesthetic, but a high level of maintenance is required.

- *Native Grass Monoculture*

A single native grass species can offer a striking aesthetic with relatively low maintenance. Mowing once a year will prevent the growth of woody plant species. Low growing grasses (less than 3 feet) with a fine texture and spreading growth habit are visually pleasing and can be used in suburban and rural areas, and in some urban settings.



This ground cover monoculture forms a thick carpet of vegetation and omits the need for mulch

- *Flower Monoculture*
Flowers are not often used in a monoculture, but they are occasionally used in large swaths at interchanges, intersections and along rights-of-way. Multiple varieties or cultivars of a single species will provide seasonal interest if chosen based on blooming time. In general, planting large masses of flowers with similar or complementary qualities, such as height and color, will achieve the same effect as a monoculture planting.

Successful design of monocultures is dependent on the form of the planting area and the health of the plants. Otherwise, consider scale and proportion, line and form prior to planting. Establish the boundary of the planting area by following the natural topography and relationships to existing landscape features.

Depending on its intended function and location, a single species may require easier and safer maintenance. For example, establishing a steep slope with shrubs or a ground cover will reduce mowing and the potential for mowing accidents. This technique does not mean that maintenance will never be required, but the maintenance techniques and tools will be different and possibly safer to operate.

One important item to consider with a monoculture planting is the ability for disease or pests to wipe out an entire planting area. Species should be chosen that are not susceptible to common diseases or pests. As an alternative, use multiple species with similar growth habits and character. This can achieve a similar visual affect as a true single-species monoculture.

Small Scale

Small scale monocultures include street tree plantings and areas such as rest areas and welcome centers. In addition to their environmental requirements, select plants based on their visual qualities, such as texture and color, that can be enjoyed at a close distance, especially by pedestrians.

Large Scale

Select plants based on their form and color, which are qualities that have the most impact at a distance. Use them in mass to stabilize slopes, or use a monoculture of flowers to provide color at focal points along a roadway corridor. Large scale monocultures will require a moderate amount of maintenance throughout the lifetime of the planting, especially weed control and the replacement of dead or dying species.



Flower monoculture with daylilies

STRUCTURE ENHANCEMENTS

Structures are an unchanging component of an ever-changing landscape. Because structures have such a dramatic visual impact, sensitivity to their design *prior* to construction is very important. The following guidelines offer suggestions for material selection and improving aesthetics of the most common roadside structures: bridges, retaining walls, noise barriers and guardrails.

Bridges

Bridges span natural features such as streams, rivers and valleys, or cross other roadways and rail lines. The visual impact that bridges have on the existing landscape is dramatic; their construction often results in steep slopes, blocked views and the removal of large amounts of vegetation. On the other hand, bridges and overpasses create viewsheds by placing the motorist at a higher viewpoint.



These patterns on the Demonbreun Street Bridge in Nashville, Tennessee, provide a unique context sensitive design solution that showcases the history of the area

The visual presence of bridges cannot be hidden or screened like many other structures in the landscape. To improve their aesthetics, consider the materials and colors of the structure in context with its surroundings. Bridge railings can be selected to respond to existing architectural or natural features; veneers can be added to abutments; the structure can be painted to add visual appeal. Vegetation can also be used to soften the structure and stabilize adjacent slopes. Engineering more gradual slopes or adding terraces or retaining walls at the abutments can reduce vegetation maintenance by creating environments where plants can thrive.

Improving Aesthetics

Vertical Surfaces

Consider the materials and surface treatments provided in this chapter to provide visual interest to structural walls and other surfaces. Material choice can reduce visual impact by blending the structure into the surrounding landscape or can create a positive visual impact by calling attention to it with unique design.

Corridor Design

As illustrated in Figure 4.1, use consistent design treatments, both structural and aesthetic, when bridges are in close proximity to one another or if they exist within the same viewshed. Consider the experience of traveling past, over or under the sequence of structures; repetition applies to structures as well as plants. For consistency, design treatments can be similar on all side slopes, retaining walls and abutments, creating a common language and



These bridges have been painted red to create a consistent theme and to add visual interest



Flowers, like these daylilies, add a splash of color at bridges

sense of place. Designing on a large or regional scale can help motorists identify where they are by associating the landscape with a specific place.

Vegetation

Use vegetation and alternative erosion prevention materials in place of riprap, when possible. Preserve existing plants to the degree possible, since vegetation removal increases stream temperatures and affects stream ecology. Preserving vegetation also saves money by reducing the time and maintenance it takes to establish new plant material. Install new plantings parallel to topography to make an overpass appear longer or to emphasize the structure's horizontal nature. Arrange tall vegetation at abutments to make an overpass appear smaller or to emphasize the structure's vertical nature.

Retaining Walls and Noise Barriers

Retaining walls and noise barriers are common features in the roadside environment that can receive similar aesthetic treatments. Noise barriers increase quality of life in residential and public areas along roadways, but residents also report feelings of “being walled in” if their property is the one to receive the wall. From a motorist's perspective, noise barriers can improve aesthetics by reducing the visual clutter that exists along roadways, but long spans of wall can be monotonous and create a feeling of driving in a tunnel.

Design, placement and integration of vegetation will determine a wall's visual impact. The form and location of the wall in relation to the roadway determines the number of options a designer has for reducing the visual impact or enhancing the aesthetics of the wall. When conditions permit, place the wall away from the shoulder to allow space to plant vegetation. This helps reduce the visual impact of noise barriers and creates a sense of openness in the roadway corridor. When conditions prohibit area for vegetation, apply a texture or color to enhance the wall's aesthetics.

Design of New Structures

When possible, use earth berms in combination with the retaining walls and noise barriers to reduce their height. Earth berms also create more opportunities to work with vegetation. Respond to changes in topography by gradually and evenly stepping the wall in large sections to follow the slope.

The height of noise barriers is limited to 25 feet, but plan for shorter walls to reduce the amount of material and lessen visual impact. When parallel noise barriers exist, the distance between the walls must be at least 10 times greater than the height of the walls to be effective at reducing noise (FHWA). Cap the noise barrier and maintain an even line at the top where panels meet.

Materials

Retaining walls and noise barriers are constructed of metal and concrete, both of which can receive unique treatments for a desired aesthetic effect. As discussed in the materials section, the walls can be stamped, stained or painted to add visual interest. Patterns and colors should be chosen to fit the context of the existing landscape.



This new noise barrier uses even lines, wall and post caps, and a stamped concrete pattern to enhance its appearance



Using the same stamped pattern on all walls within a project (retaining wall and noise barrier, as shown above) creates consistency



The vines cascading down this retaining wall and the vegetation at the base soften the wall's appearance

Vegetation

Preserve existing vegetation when possible rather than establishing new plant material. Newly planted vegetation must be given enough room to grow between the wall and the road shoulder. Options include trees planted in front of the walls as a screen, shrubs planted at the base of the wall as a foundation to soften its appearance, or vines that will attach to the wall with aerial roots (e.g., Virginia creeper, trumpet creeper). Depending on the orientation of the wall to the sun, new plant species must be especially tolerant of harsh conditions. Care from the wall can intensify harsh growing conditions.

Guardrails

Guardrails are used along roadsides to prevent collisions with roadside obstacles and to protect motorists from non-recoverable slopes. Sometimes they are used to divide pedestrians and bicyclists from vehicular traffic.

Structural material and maintenance of guardrails affect the visual quality of the landscape. The cable guardrail is becoming more common throughout Tennessee along interstates and full access controlled arterials. The standard steel W-beam rail with steel beam or wood supports is the most common guardrail found throughout the state's roadway system. Each type of guardrail has various impacts on visual quality of the surrounding environment. Cable guardrails are not visually obtrusive and allow views to the roadside landscape. Typical galvanized steel guardrails are visually prominent along roadsides and can impact the surrounding scenic quality. Paint can be used on steel guardrails to soften their visual impact; this treatment is often used in scenic or historic areas.



The guardrails in this historic district were painted brown to blend in with the surrounding landscape

