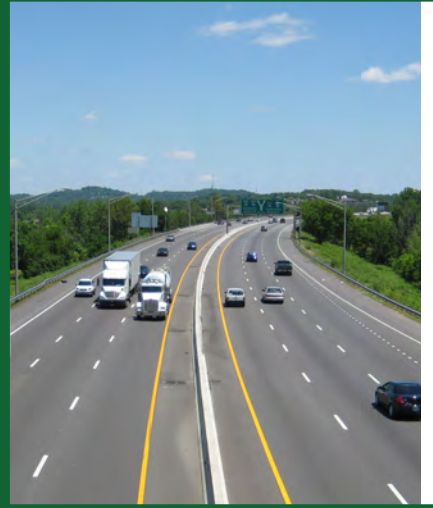




TENNESSEE DEPARTMENT OF TRANSPORTATION

LANDSCAPE DESIGN GUIDELINES



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Roadscapes[™]
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TENNESSEE DEPARTMENT OF TRANSPORTATION
Landscape Design Guidelines



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INTRODUCTION

Roadways affect our daily lives in ways that most people may not consider. They take us to work, take us home, bring industry and allow us to explore new places. They are a catalyst for memories of Sunday drives and road trips and can create stress in the event of rush-hour traffic. The roadside environment has the ability to mitigate stressful situations and create a lasting memory.

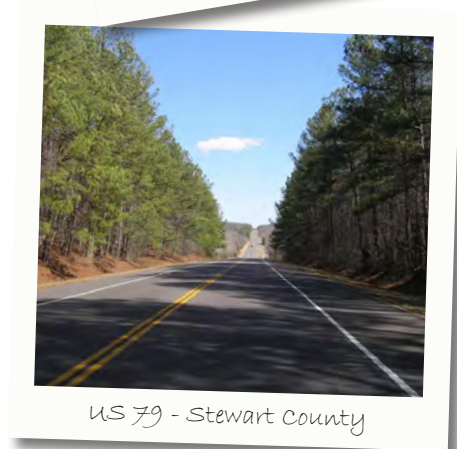
Many community leaders and residents understand that aesthetic improvements to their roadsides, whether a landscaped interchange or downtown streetscape, will instill community pride, benefit the environment and fuel the local economy by enticing people to stop in a community for a meal, a night or a lifetime. The visual qualities of a place influence the first impressions of visitors and passersby and provide daily enjoyment to residents and commuters alike.

When the roadways that run through a community create a negative impression or become a maintenance problem, improving the situation may seem overwhelming. Oftentimes, roadway design criteria and policies intended to make roadways safe and efficient are misinterpreted, which can contribute to an unattractive roadside environment or frustration to those who try to implement enhancements. These landscape design guidelines are intended to aid in improving the roadside environment and raise the level of awareness of the surrounding landscape's role in Tennessee's roadway system.

Background

The Tennessee Department of Transportation (TDOT) saw a need to develop a set of landscape design recommendations for the roadside environment that responds to safety requirements, design criteria and maintenance needs.

In August 2005, 320 online surveys were sent to community leaders, including convention and visitor's bureaus, chambers of commerce, and parks and recreation departments across Tennessee. The survey asked questions about a statewide TDOT-sponsored comprehensive landscape program. Survey respondents believed the primary benefits of such a program would be a boost in community pride and an increase in economic development. Other benefits were improved quality of life and increased tourism. Subsequent public meetings held across the state echoed these sentiments.



QUICK FACTS

TDOT oversees a multi-modal transportation system consisting of highways and bridges, aeronautics, waterways, railroads, public transit, bicycle and pedestrian facilities, and transportation management. This manual focuses on the state's roadway system that is made up of:

- 1,073 miles of interstate
- 13,077 miles of state roads
- 8,112 state-owned bridges
- 11,407 locally-owned bridges
- 19 interstate rest areas
- 13 interstate welcome centers
- 9 truck weigh stations



Wildflowers at I-55 Welcome Center



State Route 91 - Carter Co.



I-40 - Greene Co.



Stone Wall on US 70S - Belle Meade

Purpose

This manual will provide a broad audience with recommendations to plan, design, install and manage the roadside environment for both new road projects and existing roadways. This audience includes TDOT professionals, maintenance workers, community officials, landowners, designers and anyone who wants to be involved in enhancing Tennessee's roadways. These guidelines should also be used by groups that are preparing Transportation Enhancement and Roadscapes grants.

This manual provides a new process for designing and maintaining roadway environments with respect to roadway character, the surrounding landscape, cost variables, maintenance resources, safety and time. When these factors are considered in design and maintenance plans, residents, tourists, and state and local officials all benefit.

CHAPTER 1

GETTING STARTED

Achieving a successful roadside enhancement project can be confusing if there is a lack of understanding between the roadway policymakers, community leaders or officials, landowners, maintenance crews and designers. Finding an acceptable solution for all parties can be a difficult process if there is no direction. The confusion can also be compounded by the rules and regulations of roadway design and maintenance. Terminology used in the roadway design manuals is not always common to the lay-person; the guidelines and criteria are not always understandable and the visions for the project are not always clear. This manual seeks to make the process less complicated and intimidating by providing recommendations that work within established roadway design polices.

This chapter outlines a step-by-step planning and design process to be used for roadside enhancement projects and an overview of the roadway design criteria that will impact roadside enhancement projects. Preparing a well conceived plan will have lasting payoffs, including reduced maintenance, aesthetic appeal, enhanced economic development and fewer unwanted surprises.

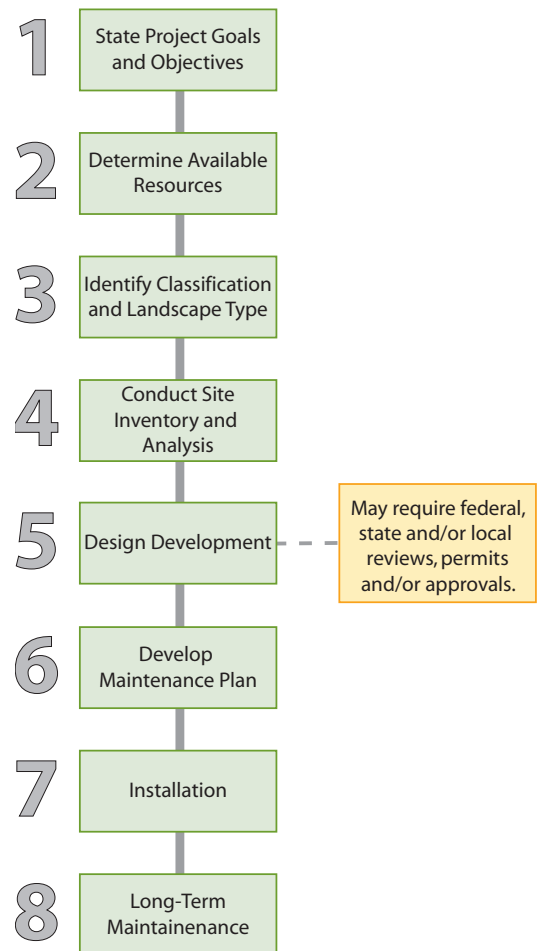
PLANNING AND DESIGN PROCESS

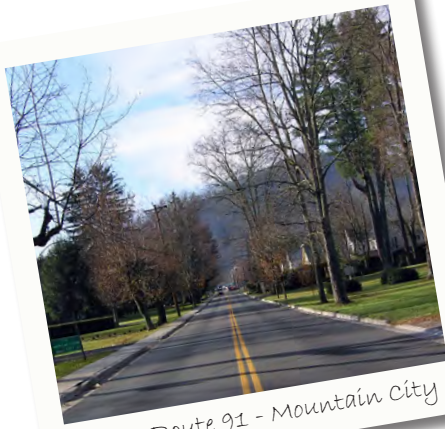
Roadside enhancement projects may be installed as part of a new road project or to enhance an existing roadway. The standard TDOT-installed landscape is turf, but may include other plant materials as required for buffers or mitigation. Local governments can beautify their roadsides with a variety of plant materials but must obtain approval from TDOT if the project falls within the federal or state right-of-way. Local governments can also enhance the roadside environment by applying for Transportation Enhancement and/or Roadscapes grants. These types of projects will require close coordination between the local government and TDOT, as well as a maintenance agreement.

Regardless of the project type, several factors must be considered during the planning and design process in order to maximize aesthetic and economic benefits and protect natural environments. This section provides an overview of the planning and design process that is explained in detail in each chapter of the manual. Some steps of the process may vary by project, but the overall objective is to provide a step-by-step guide (Figure 1.1) by which a project can go from an idea to installation to long-term benefit.

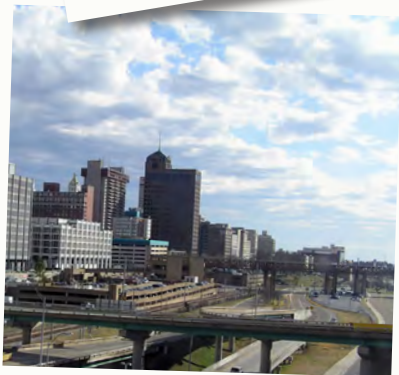


Figure 1.1: Planning and Design Process





State Route 91 - Mountain City



View of Memphis from I-40E



I-81 Welcome Center - Bristol



Medical Center Parkway - Murfreesboro

Step 1. State Project Goals and Objectives

By defining goals and objectives, one may find that the project scope is much larger than previously thought, or can be achieved by doing less than imagined. Each project's goals and objectives will vary, but this step is necessary for starting a project by providing a clear vision, intent and desired function of the end product.

A goal is a statement that describes, in general terms, a desired outcome and sets the direction of the project. To define the goal or goals of the project, ask the following questions: What should the roadside enhancement project achieve? Why do improvements need to be made? The answer can be as simple as one: improve aesthetics. Or, several answers may result: retain or attract business, reduce maintenance to save on costs and fix eroding banks to improve water quality.

Objectives are more practical concepts that describe the specific task that is to be achieved. Whereas goals are the 'what' and 'why,' objectives are the 'how.' Objectives begin to define the nature of the project. How they are implemented and what design techniques are used will be determined by the following steps.

Step 2. Determine Available Resources

Next, one must consider the available funding and manpower resources for both installation and long-term maintenance in order to keep the roadside looking its best throughout its lifecycle. Aesthetics do not have to be sacrificed because of limited resources — a smaller, well kept landscape is much more appealing than a large, unkempt one.

For new roadway construction and renovation projects, budgets are determined by federal, state or local agencies long before design. It is important to anticipate and plan for the enhancements or landscape materials that will be part of the project so they can be budgeted accordingly. Again, these do not need to be high cost items to contribute to a well designed, aesthetically pleasing landscape. Many of the enhancements can be performed at no additional cost by simply choosing different materials or treatments.

For enhancements along existing roadways, funds will typically come from local governments, special interest groups and other organizations. Funding assistance for roadside enhancement projects is available through many federal, state and local programs; however, these funds are typically for planning and installation costs, not

maintenance. Proper maintenance funding is critical to prolonging a project's benefits and resources should be closely evaluated. In order to help maximize available resources, Chapter 6 provides sample design solutions based on a range of available funds and maintenance.

Step 3. Identify Classification and Landscape Type

The next step is to identify the project's classification and landscape type. Landscape classification is the overall character of the roadside enhancement site and its surrounding landscape. The landscape type is the project's setting, such as an interchange, right-of-way or highway facility. Chapter 2 provides a process for determining a site's classification as urban, suburban, rural or community, as well as descriptions and images of the different landscape types. A project's classification and landscape type will determine the design solutions and recommendations provided in Chapter 4.

Step 4. Conduct Site Inventory and Analysis

A thorough site inventory and analysis must be conducted to document a site's existing conditions and identify its opportunities and constraints. This process documents natural and built features as well as safety and design criteria. Chapter 3 describes this process in detail and provides helpful guidelines and tools for completing a site inventory and analysis.

Step 5. Design Development

This is perhaps the most detailed and labor intensive step to the planning and design process. This step involves design (from concept to construction drawings), and material research and selection. Chapter 4 provides a thorough discussion about design development and material selection.

This step may also include community input, assistance from design professionals, and federal, state and local permits, reviews and approvals. For example, projects that include clearing, grading or excavation that result in an area of disturbance of one or more acres will require an NPDES Storm Water Construction Permit through the Tennessee Department of Environment and Conservation (TDEC). This application process includes the preparation of a Notice of Intent (NOI) for Construction Activity and a site-specific Storm Water Pollution Prevention Plan (SWPPP).



Projects that are funded in whole or in part with federal funds or have major federal actions must follow the requirements of the National Environmental Policy Act of 1969, widely known as NEPA, as well as related federal and state environmental regulations. Certain state-funded transportation projects undertaken by TDOT or by local governments for TDOT are subject to a state-level environmental evaluation, the Tennessee Environmental Evaluation Report (TEER). The TDOT Environmental Division's *Tennessee Environmental Protection Manual* (TEPM) and the Environmental Division's website (<http://www.tdot.state.tn.us/environment/>) provide additional information regarding the NEPA process. Furthermore, projects funded by federal funds will also be reviewed by the TDOT Right-of-Way Division.

Plans required for review by TDOT may include, but not be limited to, landscape plans, a traffic control plan, and a plan indicating sight distances, clear zones and stopping distances. These plans should be sealed by the appropriate professionals (i.e., engineers, landscape architects) and must comply with TDOT standards. Depending on the project type and location, the plans will be reviewed by TDOT's regional horticulturalists and traffic engineers, Right-of-Way Division staff, Environmental Division staff, Design Division staff and others.

The important thing to understand about this step is that this process takes time. The development of plans and the review process will take several months. Depending on the scale of the project and site-specific factors, it may take more than a year before a project is approved. Coordination on the front end will help make the project run more smoothly, but the process still takes time.

Step 6. Develop Maintenance Plan

Before installation, it is important to develop a maintenance plan for the care of the project. Determine who will maintain a project, how often it will be maintained and the funding that will be required. Roadside enhancement projects are a large investment with big payoffs if maintained properly. Having a maintenance plan in place prior to installation will protect the investment and contribute to its long-term success. Chapter 5 provides suggestions for developing a maintenance plan.

Step 7. Installation

Proper installation will contribute to a roadside enhancement project's immediate success and will prolong its lifespan. Chapter 5 describes techniques for site preparation and installing plant material.

Step 8. Long-Term Maintenance

Finally, the implementation of the maintenance plan is, perhaps, the most important step of all. Proper maintenance will keep the roadside enhancement project looking its best for as long as possible. All projects have a lifecycle, but proper maintenance will extend a project's aesthetic appeal. Chapter 5 describes maintenance techniques and recommendations for watering, mowing, pruning and weed control. Chapter 5 also provides guidance on the development of a long-term maintenance plan.

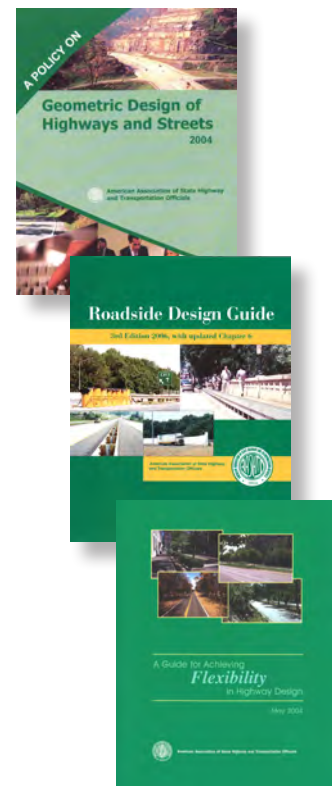
ROADWAY DESIGN CRITERIA

Now that the planning and design process has been described, it is important to understand the roadway design criteria and the policymaking bodies who develop and maintain them. These design criteria will have a major impact on the design of all roadside enhancement projects.

The Policymaking Bodies

The Federal Highway Administration (FHWA) is a federal agency under the U.S. Department of Transportation that is responsible for keeping America's roads and highways safe and efficient. The FHWA also provides funding to state and local governments for roadway projects. The American Association of State Highway and Transportation Officials (AASHTO) is an association comprised of highway and transportation departments across the United States. AASHTO establishes the geometric design criteria and transportation-related policies to provide safe and efficient roadways. The Tennessee Department of Transportation (TDOT) has developed its own design criteria, standards and procedures around AASHTO's design criteria.

These federal and state design criteria must be used when designing roadways and the roadside environment in the state of Tennessee. This manual adheres to the design criteria published by AASHTO's *A Policy on Geometric Design of Highways and Streets* and AASHTO's *Roadside Design Guide*, as well as the guidelines in the *TDOT Roadway Design Guidelines*.



QUICK FACTS

In Tennessee, the interstate system accounts for only 1.2% of the state's total miles of roadway; however, 28.8% of total travel occurs on interstates. The local roadway system accounts for 69.2% of the state's total road length but only 12.7% of total travel.

Source: TDOT 2007 ADT Book

Other federal, state and local agencies may be consulted depending on the nature of the project. For example, a project may require coordination with the Tennessee Department of Environment and Conservation (TDEC) if it impacts a waterway, threatened or endangered species, or a historic property. Likewise, local governments may have their own design standards for roadside enhancements, such as streetscapes and gateways, that must be consulted during the design phase.

Definitions

The following terms are used throughout this manual when discussing the roadway design criteria that impact roadside design. These terms are explained in much greater detail in the manuals listed previously and in the Appendix.

Average Daily Traffic

The average daily traffic count, or ADT, is the total volume of vehicular traffic along a roadway. It is used to measure how busy or heavily traveled a roadway is. TDOT's Project Planning Division keeps a record of these counts in yearly Traffic Flow Map books, which can be found at <http://www.tdot.state.tn.us/projectplanning/adt.asp> or ordered from the Long-Range Planning Division. These counts, arranged by county, are taken along all major roadways throughout the state.

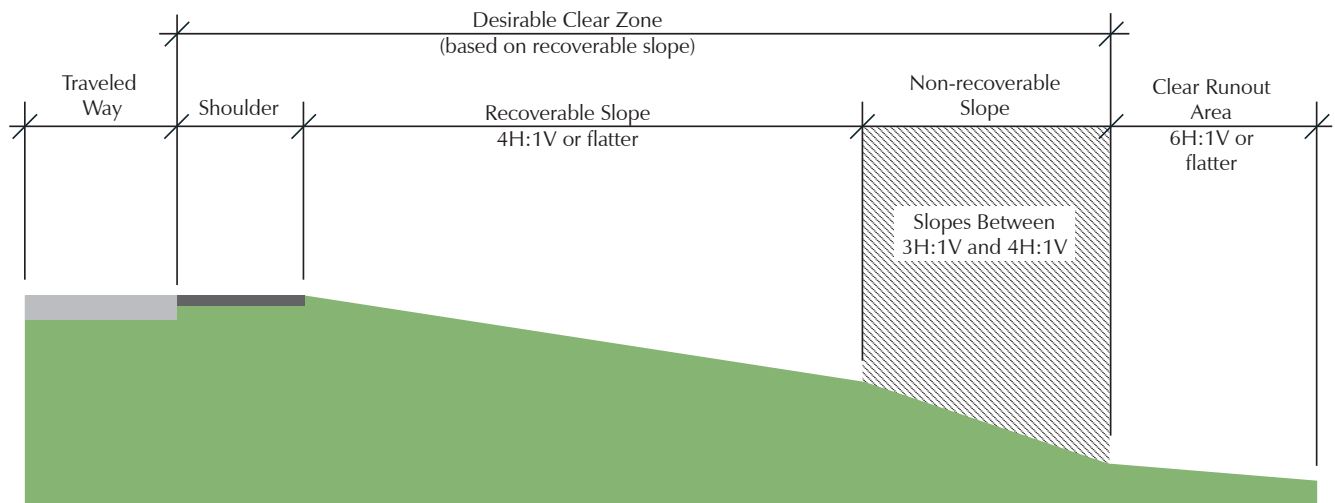
Clear Zone

The clear zone (Figure 1.2) is the distance from the edge of the traveled way that allows an errant vehicle to stop safely or recover control.

The clear zone is comprised of the roadway shoulder and a recoverable slope, but may also include a non-recoverable slope and/or a clear runout area. A recoverable slope is one on which an errant vehicle can regain control. Recoverable slopes are defined as being flatter than 4H:1V (25%). A non-recoverable slope is considered traversable, but a vehicle is not able to regain control and will continue to the bottom of the slope. Slopes between 3H:1V (33%) and 4H:1V (25%) are considered to be non-recoverable. The clear runout area is at the toe of the non-recoverable slope and is generally 6H:1V (16%) or flatter.

The minimum width of the clear zone depends on roadside geometry, design speed, traffic volume, crash history, and the presence of curb and gutter, guardrails and other barriers. On roadways with design speeds less than 45 mph, consult AASHTO's *Roadside Design Guide* and the TDOT Design

Figure 1.2: Clear Zone Concept



Division for engineering guidance of site-specific clear zone requirements. On roadways with design speeds of 45 mph or greater, only turf, native and ornamental grasses, and flowers are appropriate vegetation choices for the clear zone.

Context Sensitive Solutions

The roadway policymakers can do their part to respond to the needs of communities and the surrounding landscape without sacrificing safety. In the best case scenario, a community will be involved in the planning process long before the road is designed. This inclusive process is commonly known as Context Sensitive Solutions (CSS). The process has been used successfully to design roadways that respond to traffic needs while remaining sensitive to the context of the surrounding landscape (e.g., culture, aesthetics, history, environmental features, future goals of the community, etc.).

While this manual's premise lies in the idea of Context Sensitive Solutions, it will not include discussing the CSS process. Instead, this manual will support TDOT's commitment to CSS, which is to *"serve as a partner with the citizens of Tennessee in creating cost effective transportation investments that consider all modes of transportation and complement the natural beauty, economic vitality and livability of the state."*

The Demonbreun Street Viaduct in downtown Nashville was designed following CSS principles. This project incorporated aesthetic elements in its design from Nashville's history, including its train and music heritage.

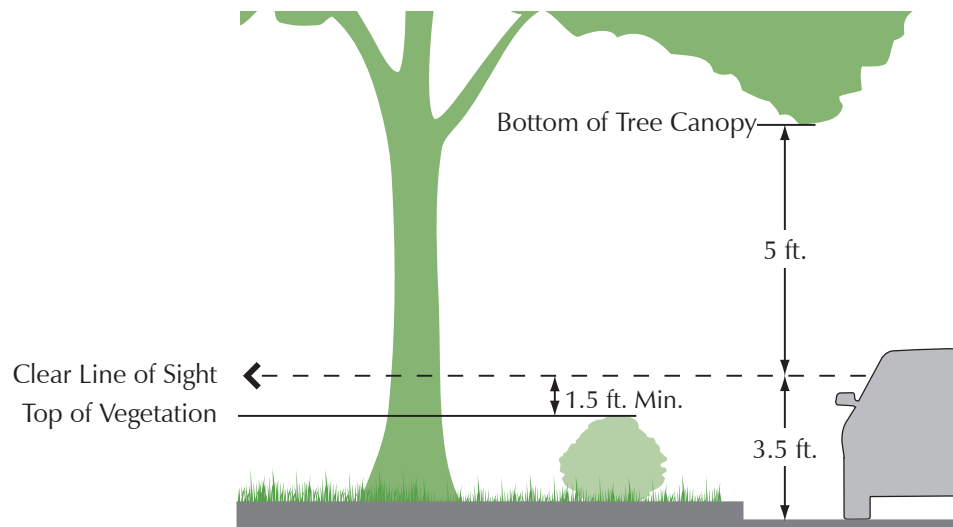


Sight Distance

Sight distance is the length of roadway that is visible to a driver. AASHTO's *A Policy on Geometric Design of Highways and Streets* defines several types of sight distances, but for the purpose of roadside enhancement projects, this manual will discuss sight distances at intersections, known as sight triangles, and around horizontal curves (e.g., interchange ramps). These areas must be clear of obstructions that block the driver's view, per the TDOT Design Division's Roadway Standard Drawings.

The vertical limits of the sight triangle should be clear between 3.5 feet and 8.5 feet above grade to create a clear sight window as shown in Figure 1.3. The top of any shrubs, ground covers or other vegetation should be a minimum of 1.5 feet below the clear line of sight, or a maximum of 2 feet above grade.

Figure 1.3: Clear Sight Window



At intersections, the size of sight triangles is based on the speeds of the intersecting roads and can be determined by consulting the TDOT Design Division's Roadway Standard Drawings. The sight triangles at intersections (Figure 1.4) perform two functions: they allow drivers that are approaching an intersection to see oncoming vehicles on the intersecting road and they allow a stopped driver on a minor road adequate sight distance to depart from an intersection to enter or cross a major road.

This concept applies to medians as well (Figure 1.5). The ends of the medians must be clear of objects that will obstruct the driver's view. The TDOT Design Division's Roadway Standard Drawings provides charts to determine the size of the sight triangles on divided and undivided roadways.

Figure 1.4: Sight Triangles at Intersection

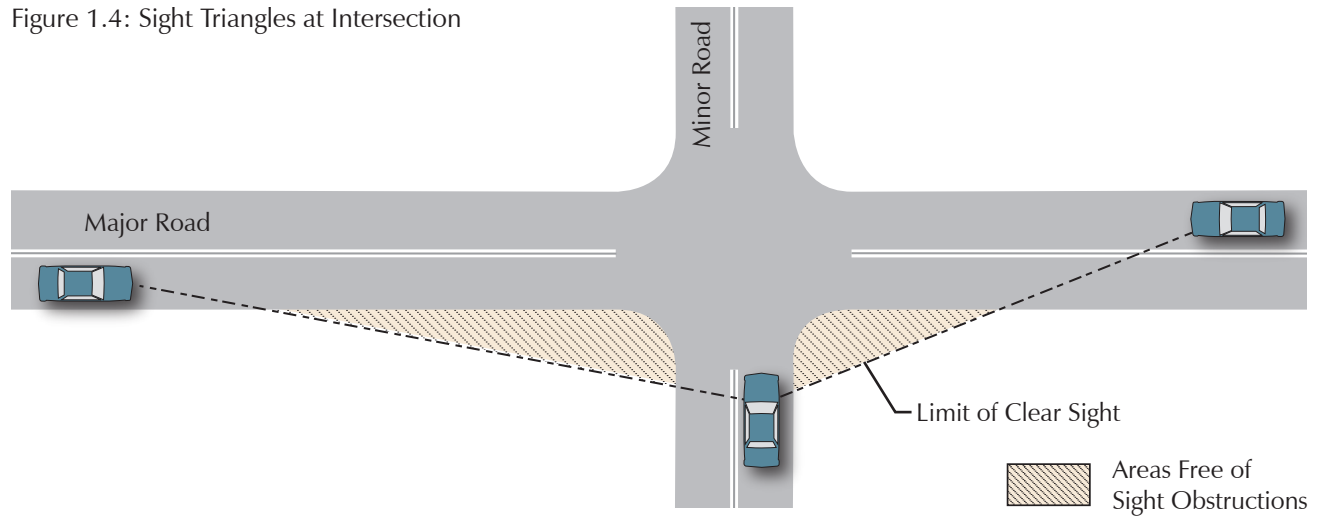


Figure 1.5: Sight Triangles at Intersection with Median

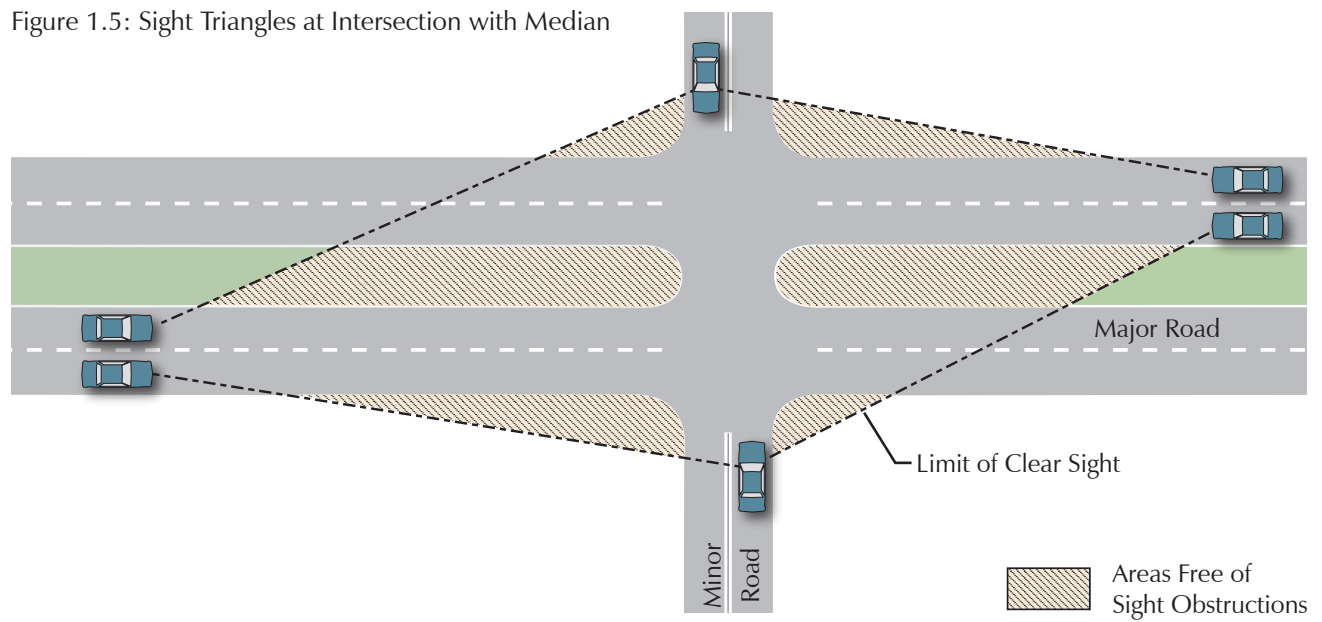
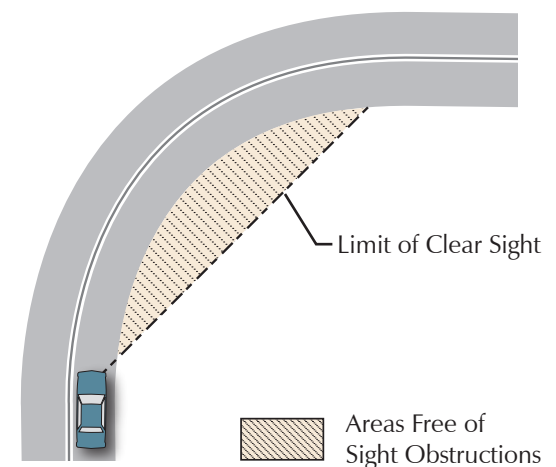


Figure 1.6: Sight Triangle at Horizontal Curve



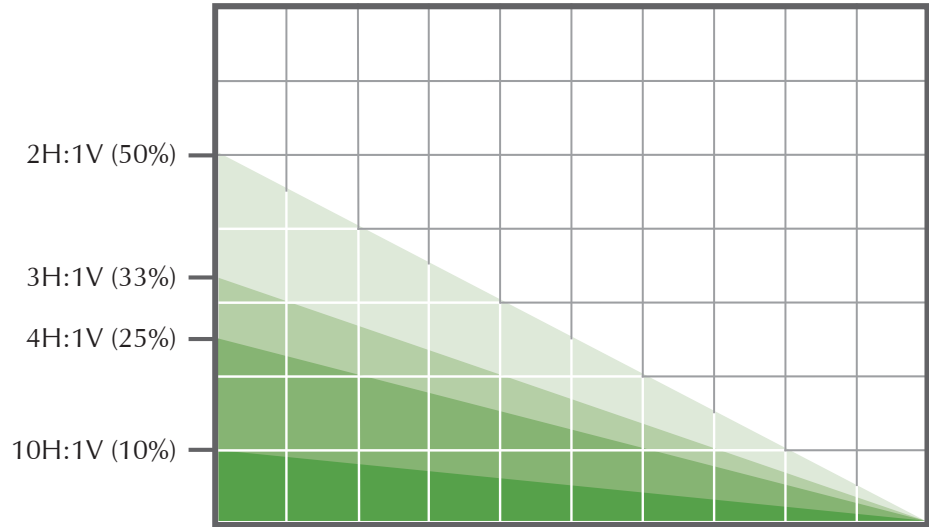
The sight distance on horizontal curves allows drivers to have a clear view around the curve in order to have adequate time to stop. It is measured from the center of the driving lane and is determined by the radius of the curve and the stopping distance, which is related to speed. AASHTO's *A Policy on Geometric Design of Highways and Streets* (Chapter 3) provides charts and equations for determining the sight distance around horizontal curves.

Items like utility poles, sign posts and tree trunks should not obstruct more than 50% of the sight triangle and should be spaced to allow for a clear view.

Slope

Slope is a measurement of steepness. Slope is determined by dividing the rise (vertical distance) by the run (horizontal distance) between two points. The greater the slope, the steeper the incline. Slope is often written in one of two ways: as a ratio (H:V) or a percentage (%). For example, a slope can be shown as 4H:1V (or 1 foot vertically for every 4 feet horizontally) or 25%.

Figure 1.7: Slope



CHAPTER 2

LANDSCAPE CLASSIFICATIONS AND TYPES

LANDSCAPE CLASSIFICATIONS

Four classifications have been developed to define the general character of roadway corridors and the surrounding landscape. The classifications are urban, suburban, rural and community. These classifications were developed because each one has different design solutions based on how heavily a roadway is traveled, the available roadside in which to do an enhancement project, the resources available to install and maintain a project, the appropriateness of a design based on the character of the place and the expectations of the community. Each classification has inherent characteristics and qualities that will influence the design of a roadside enhancement project. The design must respond to a classification's qualities in order to be successful and manageable.

Determining Landscape Classification

Eight factors that contribute to the determining the classifications have been identified as:

1. Population Density
2. Location
3. Development Patterns
4. Land Use
5. Natural Features
6. Transportation Options
7. Utilities and Signage
8. Unique Characteristics

These factors are interconnected with one another and cannot be examined individually to determine a site's classification. For example, a downtown streetscape in rural Tennessee likely has urban characteristics, even though the population density is low. Conversely, a site within the city limits and only a five-minute drive from a downtown area may be primarily characterized by open space and sparse development, lending itself to a more suburban or rural character. The site should be examined holistically to determine the overall character before determining its classification.

The following pages describe each of these factors along with a side-by-side comparison of urban, suburban and rural characteristics. The community classification is explained later, as its characteristics vary. These descriptions will aid in determining the overall character of a roadside enhancement project area.

Population Density

Population density is a measurement of the number of people per unit area. This manual defines its own population densities as people per square mile, using the Census Bureau’s definition of urban areas as a basis. Higher population densities mean less open space that must be shared by larger amounts of people. The places listed below qualify as urban, suburban and rural based on their population density alone, but other factors may sway that determination. For a roadside enhancement project, this can mean the number of people who may benefit from a project on a daily basis.

URBAN

- at least 1,000 people per square mile

Examples:

Chattanooga
 Clarksville
 Cleveland
 Collierville
 Cookeville
 Johnson City
 Knoxville
 Memphis
 Nashville

SUBURBAN

- 500 to 1,000 people per square mile

Examples:

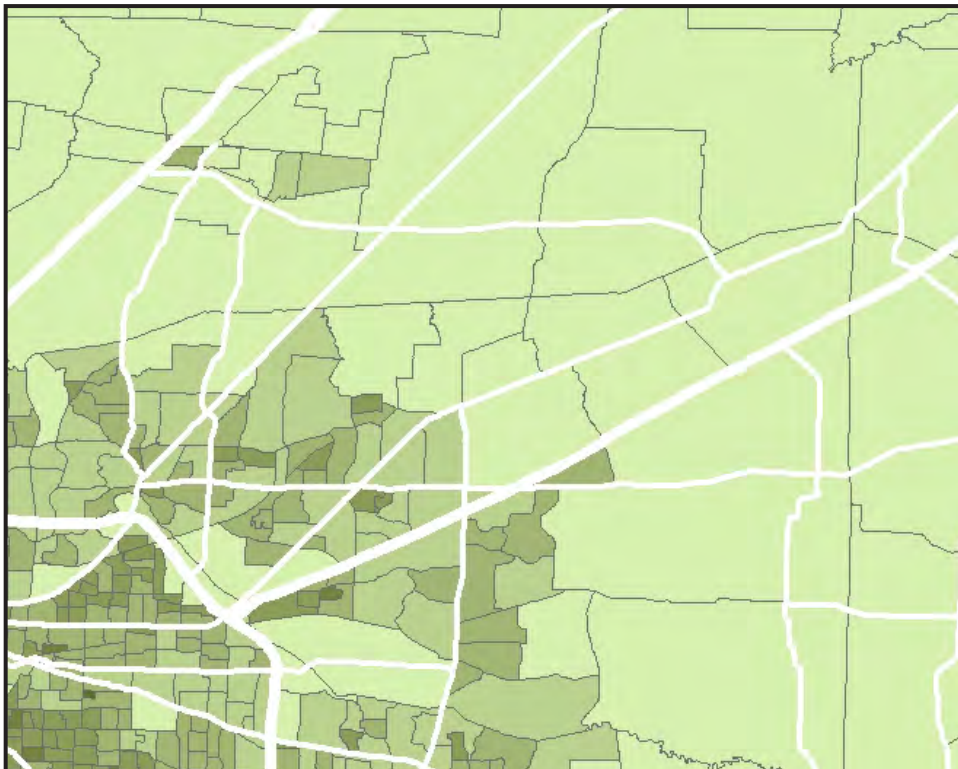
Alcoa
 Belle Meade
 Brentwood
 Bristol
 Carthage
 Clinton
 Manchester
 Sevierville

RURAL

- less than 500 people per square mile

Examples:

Ashland City
 Dandridge
 Gatlinburg
 Monteagle
 Townsend
 Waverly



This population density map illustrates the change in density from high (dark green) in the urban center to low (light green) in the rural outskirts.

Location

Location refers to a site’s proximity to or within a municipal boundary, which defines the local governing body. Within these boundaries, there is often an expectation for certain levels of service or maintenance. For a roadside enhancement project, this may impact design regulations and available resources (i.e., funding and manpower).

URBAN

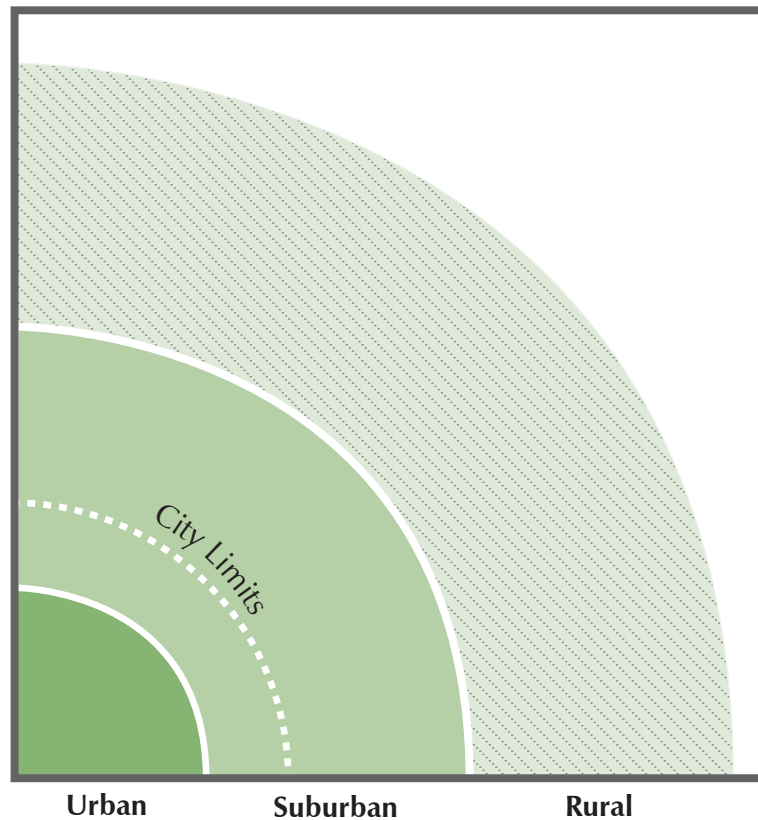
- typically defined by city limits or metropolitan areas

SUBURBAN

- can be found within or outside of city limits around urban areas

RURAL

- outside of city limits



Development Patterns

The pattern of human development varies greatly in each of the classifications as demonstrated in these diagrams. Development patterns influence roadway congestion, roadway design and the natural environment. This manual also defines development pattern by the amount of developed land in a given area.

URBAN

- more than 50% developed
- clustered development with very little open space
- significant open space is typically limited to parks and other recreation areas or in areas where environmental conditions prohibit development
- characterized by dense development on smaller lots

SUBURBAN

- 25 - 50% developed
- clusters of development surrounded by open space
- characterized by single family homes arranged on smaller, subdivided lots

RURAL

- less than 25% developed
- mostly open space with scattered development
- characterized by single-family homes on large parcels



Land Use

Land use is closely related to development patterns in that it is determined by the types of human development in the landscape. Many communities define land use through zoning laws, which determine the approved uses that can operate within any given zone. The typical land use categories are residential, commercial, industrial, institutional/public and open space/recreation. These categories can be further divided or mixed. Here, the intent is to examine the *existing* land uses surrounding a roadside enhancement project that may factor into the design. For example, a goal of a roadside enhancement project may be to screen the view to an industrial plant. Conversely, a community may want show passers-by what it has to offer by making itself visible to the roadways.

URBAN

- consists of a variety of land uses, including single family and multi-family residential, commercial, industrial, institutional and open space
- the non-residential land uses are most visible from major roadways

SUBURBAN

- primarily residential and open space with some commercial areas

RURAL

- primarily open space (agricultural) and residential

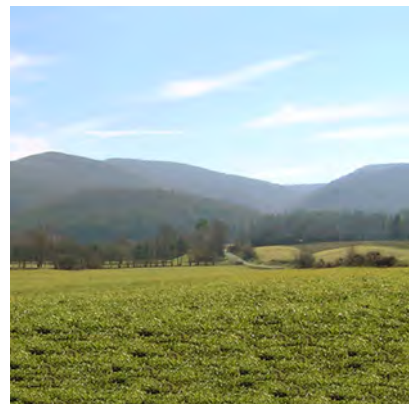
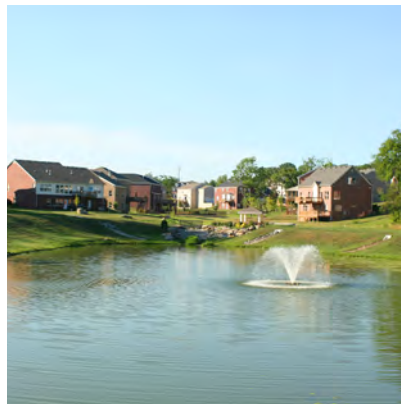


This land use map illustrates the diversity of land uses within a city. The primary land use within the city is commercial (red). Residential areas (yellow) fall outside of the city center and recreation areas (green) can be found on the fringe of the city center.

Natural Features

Rivers, wetlands, rock formations, vegetation, wildlife habitats and land forms are only a few examples of natural features. Natural features are often roadside enhancements in and of themselves. They are prevalent in all classifications, but their management and appearance differ. A stream in a rural environment may be left relatively untouched and highly visible, but in an urban environment it may be directed into a concrete channel or hidden in a pipe underground. Likewise, vegetation will be maintained differently in all classifications, from highly manicured to intermittent mowing and pruning. Natural features in the urban environment often appear groomed in some way, while in the rural environment there is very little modification.

URBAN	SUBURBAN	RURAL
<ul style="list-style-type: none"> • green space is rare, with the exception of parks or urban residential lawns • waterways are typically present but are often channeled underground • vegetation is often manicured or maintained on a regular basis by a local government’s maintenance crews • prevalence of hardscape (buildings, pavement, etc.) and lack of vegetative cover contribute to warmer temperatures or “heat islands,” which often makes the establishment of new vegetation more challenging 	<ul style="list-style-type: none"> • green space is more common between concentrated developments • waterways are visible but often channeled under or directed around developed areas by swales and culverts • maintenance of vegetation varies depending on location, visibility and purpose • maintenance is the responsibility of a local government’s maintenance crews, contract maintenance, private landowners or TDOT • the mix of less hardscape materials and more vegetative cover creates an environment that is more suitable to establishing and sustaining vegetation 	<ul style="list-style-type: none"> • green space is prevalent and consists of patches of fields and forests • waterways are visible with minimal alterations (e.g., bridge or culvert for road crossings) • maintenance is typically the responsibility of landowners or TDOT • ample green space and lack of hardscape allows for an environment suitable for establishing and sustaining vegetation



Transportation Options

Transportation options are closely related to population density and development patterns because both factor into the level of accessibility. A densely developed and populated area will require more roadways and transportation options for greater accessibility. In urban areas there are often endless options for getting from Point A to Point B, but in rural areas the options are more limited and often require longer driving distances to reach destinations. Transportation is not limited to cars on roads either. Bike lanes, sidewalks and greenways (multi-purpose trails) offer alternative forms of transportation for pedestrians and cyclists. The safety of pedestrians and bicyclists should be considered in roadside enhancement projects.

URBAN

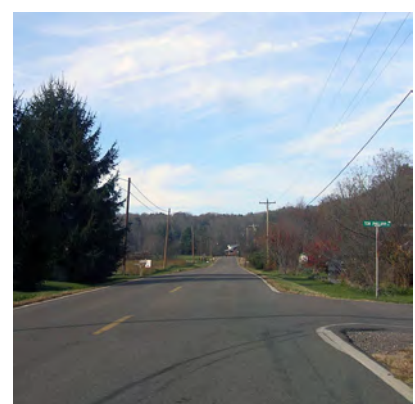
- offers the most diverse roadway system, from interstates to residential streets; people can travel between points very quickly using multiple routes
- roadways are heavily traveled, and congested traffic is more likely
- provide the most opportunity for pedestrian and bicycle transportation
- mass transit options are common
- minimal green space along rights-of-way; primarily turfgrass but some trees; invasive species are common; streetscapes are common in downtown areas

SUBURBAN

- offers a mix of roadways similar to urban areas but less concentrated; people can travel between points quickly, but have fewer route options
- morning and evening traffic congestion from commuters
- provides some opportunity for pedestrian transportation in the form of sidewalks in subdivisions but is primarily vehicle-oriented
- mass transit options are limited
- amount of green space along rights-of-way varies but are typically wider; mix of grasses, shrubs and trees

RURAL

- fewer transportation opportunities; longer driving distances and times and few route options
- no traffic congestion
- no pedestrian transportation opportunities
- no mass transit options
- abundant green space along rights-of-way; mix of grasses, shrubs and trees



Utilities and Signage

The types and quantity of utilities and signage is a good indicator of a site’s classification. The presence of more people and business requires more utilities and infrastructure. In densely developed and populated areas, the roadside environment will often contain more informational and wayfinding signage to direct motorists, as well as advertisements and billboards. These elements have strict design parameters (sight lines, clearances around utilities, etc) and will have a dramatic impact on roadside enhancement design, as discussed and illustrated throughout the manual.

URBAN

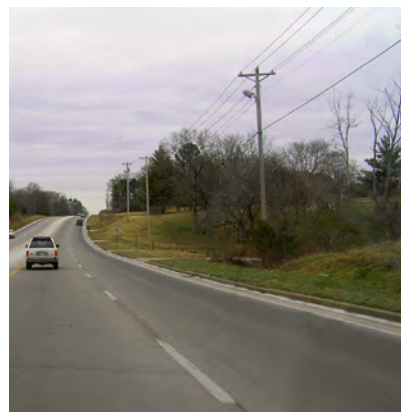
- utilities, especially overhead, and signage are especially common and highly visible
- directional, wayfinding and traffic signage is prevalent throughout urban areas
- commercial signage and billboards are typically confined to commercial corridors, but are also found along major roadways to attract passers-by

SUBURBAN

- overhead utilities prevalent and visible
- directional, wayfinding and traffic signage is infrequent and concentrated around developments
- commercial signage and billboards are confined to commercial corridors but are also found along major roadways to attract passers-by

RURAL

- overhead power lines exist along most major roadways; transmission lines are likely to cross roads
- directional, wayfinding and traffic signage is infrequent
- cell towers can be seen from great distances
- commercial signage and billboards common near major interstate interchanges



Unique Characteristics

Unique characteristics are those that make a place distinct from all others. They include historical, cultural, social, architectural or scenic qualities.

URBAN

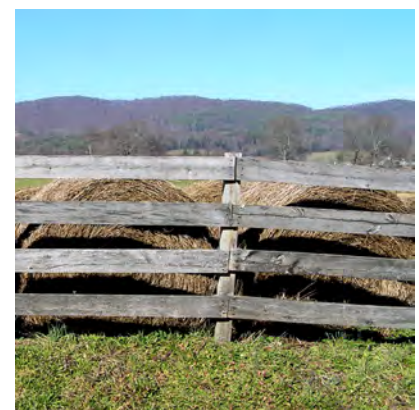
- diverse populations
- often destination points for social, cultural and recreational activities
- the civic centers for all citizens which affect everyone’s life in some way
- high rates of tourism and greater expectation for aesthetic appeal
- more citizen pressure for environmentally friendly designs and maintenance practices
- prevalence of public art

SUBURBAN

- preference for minimal visual intrusion from roadways in order to preserve visibility to homes, community and child safety

RURAL

- many farms have historical significance to families and communities
- greater emphasis on tradition and preservation of the rural character

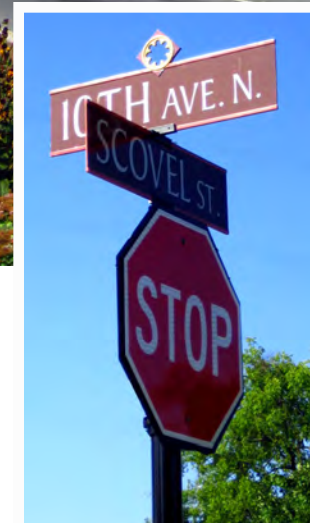


Community

A community consists of people who reside or work in an area and who share common characteristics and interests. Communities can be found in any of the classifications. A community can be a neighborhood, downtown district, area of historic importance or office park, to name a few. With respect to roadside enhancement design, a community is a unique area within a larger municipality that has its own distinct characteristics. There is a great sense of pride among community members, who often share a common goal of preserving and promoting the unique qualities of their area.



The Historic Buena Vista Neighborhood in Nashville, Tennessee, used design elements from a local church to inspire a unique identity for their community



LANDSCAPE TYPES

This manual presents several typical roadside landscapes found along interstates, state routes and other roadways. They include interchanges, rights-of-way, intersections, highway facilities (rest areas, maintenance compounds, etc.) and other unique landscape types. A variety of design and maintenance solutions within each of these typical landscapes are presented later in Chapter 6. Due to the vast quantity and diversity of roadside conditions, not every scenario can be included. However, the sample design solutions presented in Chapter 6 provide the basis for a design process that can be applied to a variety of roadside conditions and scenarios.

Interchanges

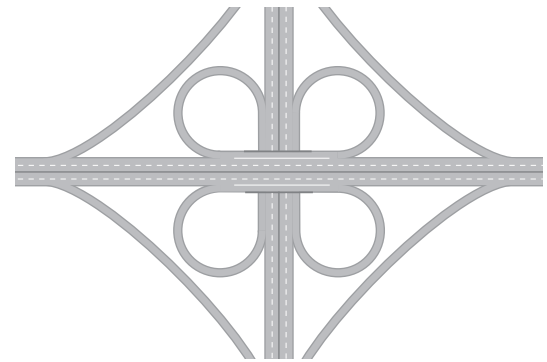
An interchange is a roadway junction that allows the movement of traffic between two or more roadways on different levels by using grade separation, bridges and ramps. In other words, an interchange allows a constant flow of traffic by allowing one road to pass over or under another instead of intersecting. The two interchange designs presented in this manual are the cloverleaf and diamond, but several variations of each exist. For example, the single-point urban interchange (SPUI) is a variation of the diamond interchange that has become quite popular because it helps move large volumes of traffic in a smaller space, hence less right-of-way acquisition. The SPUI interchange is common in urban environments where space is limited.

Rights-of-Way

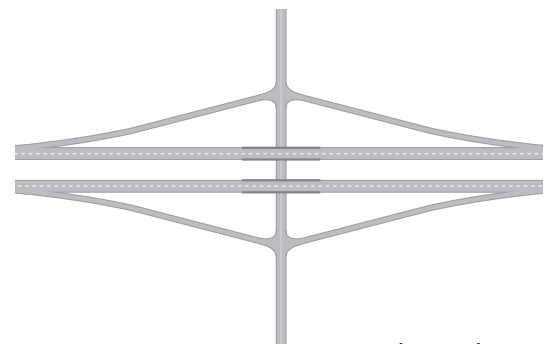
The right-of-way is the land set aside for a roadway corridor. Rights-of-way are acquired prior to new roadway construction. The amount of right-of-way purchased is usually just enough for the roadway and support structures (e.g., walls, bridges); however, additional right-of-way may be acquired and left vacant for future expansion. The right-of-way is typically narrow in urban environments where land is densely developed. In downtown and residential environments, the right-of-way line is often at the back of sidewalks. The right-of-way line along interstates and highways is usually marked by a fence.

Intersections

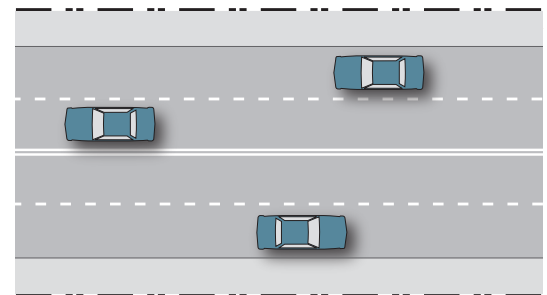
An intersection is a roadway junction where two or more roadways meet, but unlike an interchange these roadways meet at grade and require some form of traffic control (e.g., stop sign, traffic signal). The four-way intersections are a perpendicular, or 90°, junction and an angle junction. The three-way intersections are a T-junction and a Y-junction.



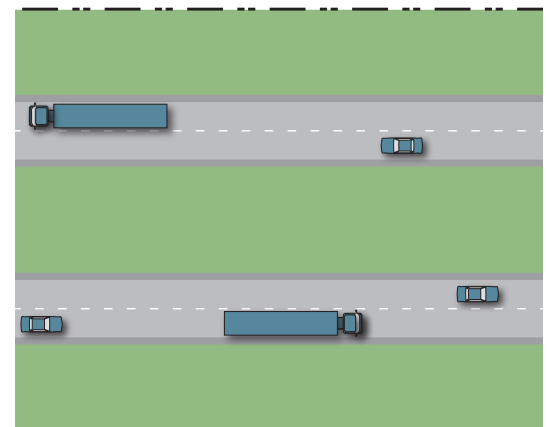
Cloverleaf Interchange



Diamond Interchange



Right-of-Way with Sidewalks



Right-of-Way with Median



I-81 Welcome Center, Bristol, Sullivan County



The Natchez Trace Parkway is part of the National Scenic Byways Program

Highway Facilities

Rest Areas and Welcome Centers

There are 19 interstate rest areas and 13 interstate welcome centers in Tennessee. In addition to the indoor facilities, these centers often offer large expanses of open space with vending, walking paths, dog walking areas, public art, benches and picnic tables. These centers provide an opportunity to show a captive audience, often tourists from out of state, the natural beauty Tennessee has to offer. Other interstate rest areas include overnight truck rest stops. These rest areas are comprised of a parking area, but no indoor facilities or walking paths.

Truck Weigh Stations

There are 9 truck weigh stations throughout the state. These facilities are located along the interstate usually near a state border. When prompted, trucks exit the interstate by a ramp, drive onto a scale to be weighed and then return to the interstate by another ramp. These facilities may also have an area behind the weigh station building that can be used for temporary truck parking.

Maintenance Facilities

TDOT operates several garage compounds for the regional and district maintenance offices and salt storage areas. These facilities can be found along interstates and state routes and are often highly visible from the roadway.

Unique Landscape Types

The following unique landscape types overlap with those already identified (i.e., a streetscape is found along a right-of-way); however, they have their own design solutions that are not specific to any landscape classification. While they must still fit into the context of their surrounding environment, their unique qualities require design recommendations that are not totally dependent on the surrounding landscape character.

Scenic Roadways

Scenic byways are those that are recognized as part of the National Scenic Byways Program administered by FHWA. The designation of these roads is based on a roadway corridor's archeological, cultural, historic, natural, recreational and scenic qualities. Roadways with one of these qualities are designated as a *National Scenic Byway*, while roadways with at least two are designated *All-American Roads*. Once a road is designated, it is provided with the resources necessary to manage and maintain the qualities that make it unique.

In addition to this federal program, Tennessee has its own scenic roadway program, the Tennessee Parkway System and Scenic Highways. This roadway system was established by the Tennessee Legislature to promote the state's scenic assets and recreational resources.

Gateways

A gateway is an entry feature that gives a sense of arrival. Gateways mark the entry point into a distinct area through the use of many landscape features, including signage and vegetation. Gateways can be found in a variety of places such as interstate interchanges, city limits or subdivision entrances, to name a few.



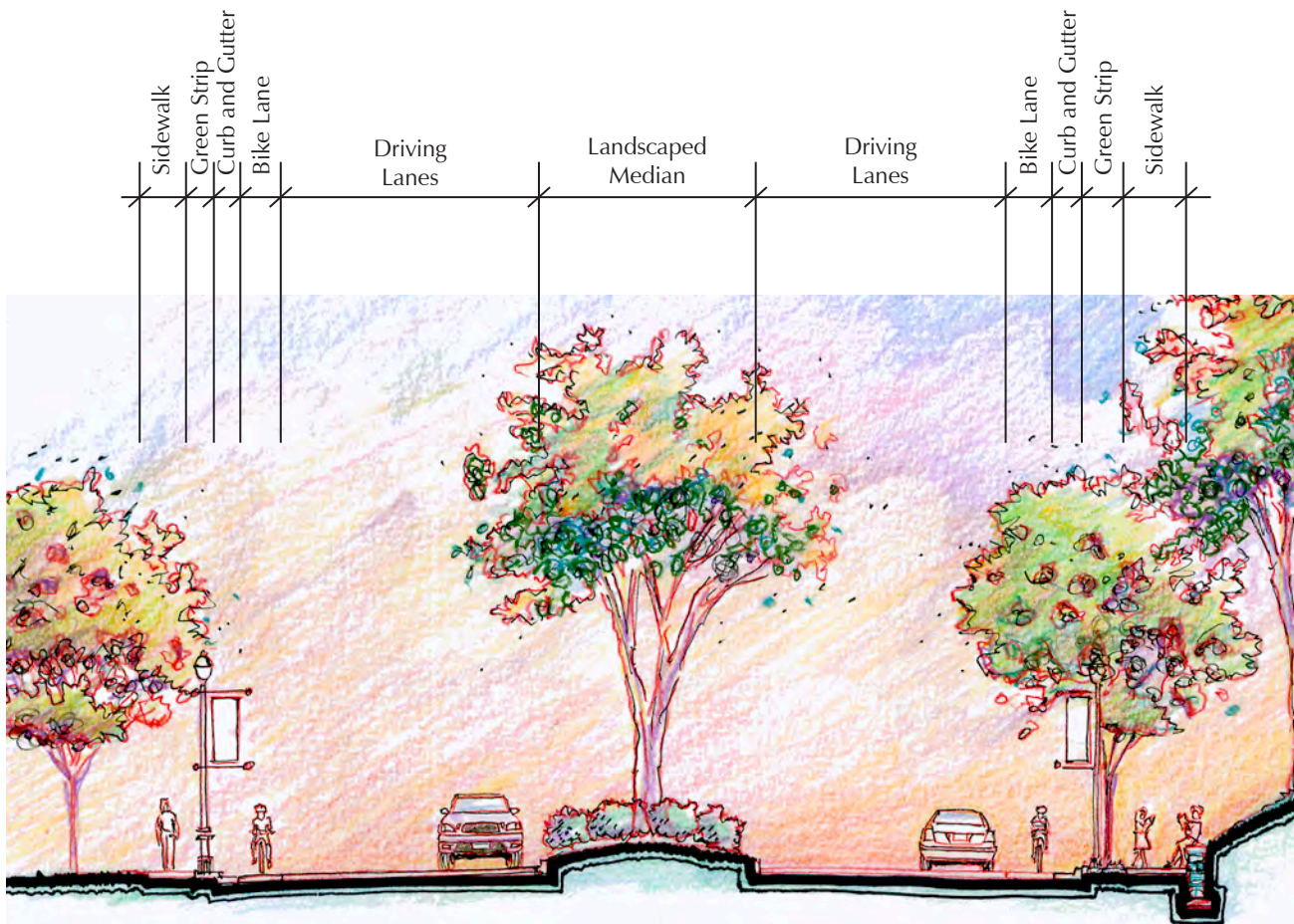
Gateways can be used to mark entry points into areas at a small scale, like neighborhoods (top left and top right) or at a large scale, like cities (bottom left)



Streetscape

A streetscape is the visual appearance of a roadway formed by elements within and along the right-of-way. A streetscape is typically comprised of pedestrian and landscape improvements including sidewalks, crosswalks, lighting, street trees and grates, medians, site furniture and signage. Streetscapes rely on established standards to create uniformity throughout a design. Standards are often developed for construction materials, colors, furnishings, plant material, and dimensions of sidewalks, driving lanes, bike lanes, medians, parking spaces or setbacks. Together, these elements define a roadway’s appearance, identity and function.

Trees, planters, ornamental light fixtures, banners and paving patterns are common in streetscapes



Streetscape section with sidewalks, bike lanes, driving lanes and a landscaped median

CHAPTER 3

SITE INVENTORY AND ANALYSIS

Proper planning prevents wasted dollars. For example, if the wrong species of tree is chosen for use under power lines, money will be lost every year to tree trimming or repair of damaged lines from fallen branches. Likewise, the selection of the wrong tree in a downtown streetscape leads to roots that spread beneath sidewalks, causing them to buckle and resulting in hazardous conditions or high maintenance and repair costs. These costs can be prevented or mitigated if a thorough site inventory and analysis is conducted and proper material selections are made.

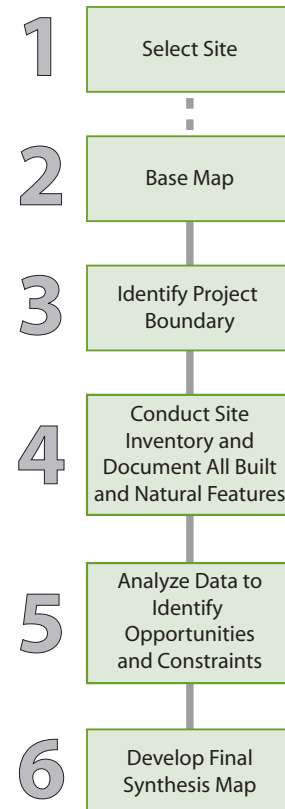
A site inventory documents a site's natural and built environment and, for the purpose of this manual, the safety and design policies established by AASHTO and TDOT. Once these conditions have been documented, an analysis of all the site's features can then be developed to identify opportunities and constraints. These include the areas of the roadside environment in which to plant and the vegetation that is best suited to a particular site. A site analysis can also determine areas that may require drainage structures or erosion prevention measures.

The following process and associated checklist will aid in the development of a detailed site inventory and analysis and will lead to a more successful roadside enhancement project. Chapter 4, *Design Development*, provides a more detailed approach to selecting plant materials based on these conditions, while Chapter 6 presents a variety of sample design solutions that respond to the opportunities and constraints determined by the site analysis.

BASE MAPS

When conducting a site inventory, it is helpful to have an aerial photograph or a site survey to assist in the documentation of existing conditions. If the roadside enhancement project is part of a new roadway project, the roadway construction plans can be used. For projects on existing roadways, maps can be found from a variety of sources, including a local government's GIS data, engineering or planning departments, online GIS and aerial photograph viewers and databases, and roadway construction plan archives (TDOT or local government), to name a few.

Figure 3.1: Site Inventory and Analysis Process



SITE INVENTORY: IDENTIFYING DESIGN PARAMETERS

After selecting a site and gathering the necessary base maps, the next step is to identify the project boundaries, which will vary depending on the type and location of the project. The boundary can be a right-of-way line, property line, median or any other defined area. After the boundary has been identified, use the *Existing Conditions Checklist* and a base map to record the existing site conditions. The physical features listed in the checklist are typical to the roadside environment and will require a site visit or a thorough land survey in order to be documented. Other items, including the utility information and clear zones, may require some research and coordination with local governments or TDOT.

The following outline helps explain what to look for when conducting a site inventory and the depth of information to be recorded. Figures 3.10 through 3.16 provide examples for documenting a site's existing conditions. When all the conditions are recorded, an analysis can be developed, as illustrated in Figure 3.17.

Environmental Conditions

Region of the State

The State of Tennessee is divided into three grand divisions: East, Middle and West. These divisions each have distinct environmental and land form characteristics. In this manual, the purpose of identifying the regions is to help determine native plant species. Native plants are adapted to particular environmental conditions and will perform better if matched to the proper region. The plant lists, found in the Appendix, indicate whether the species is native to one of these three regions.

USDA Hardiness Zone

These zones, developed by the US Department of Agriculture, represent areas in which plants will most successfully grow based on temperature. While the zones are developed based on minimum temperatures, heat can also impact a plant's survival. The zones are also divided into subzones (a and b) to cover microclimates. Tennessee is comprised of Zones 6a, 6b, 7a and 7b.

Figure 3.2: Grand Divisions

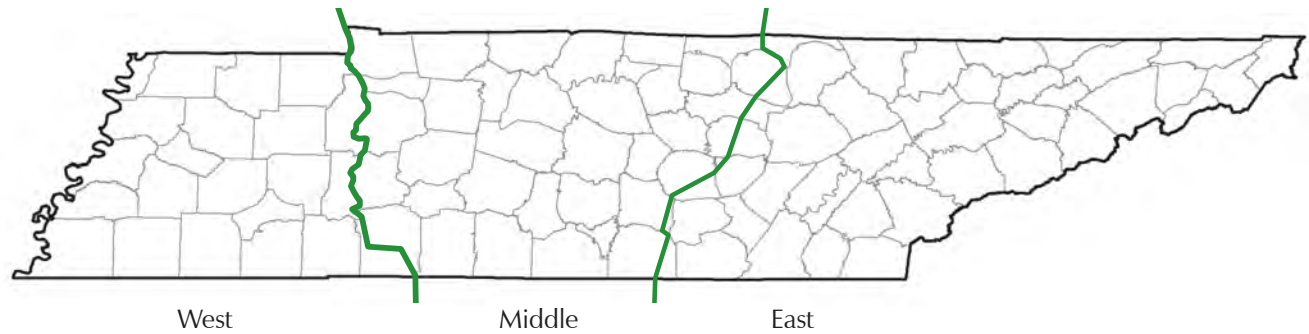
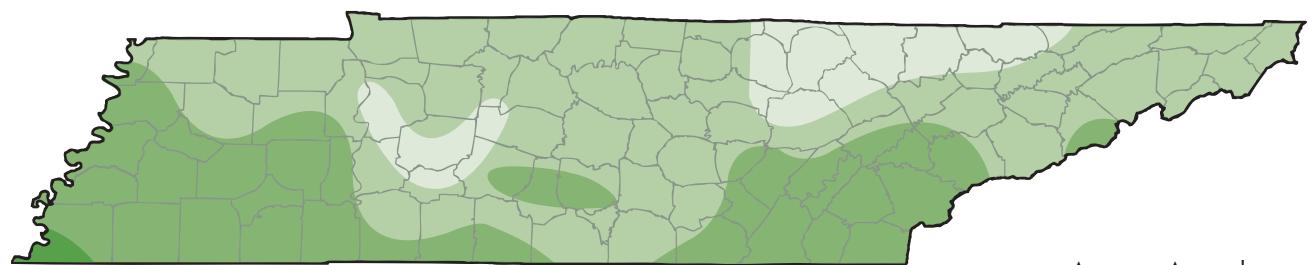


Figure 3.3: USDA Hardiness Zone Map



Average Annual Minimum Temperature

Zone 6a	-10 to -5 F
Zone 6b	-5 to 0 F
Zone 7a	0 to 5 F
Zone 7b	5 to 10 F

Light Exposure

Plants require different levels of light exposure. Generally, full sun is defined as 6 hours of direct sun or full sun all day. Partial shade is 1 to 4 hours of direct morning sun or filtered sunlight all day. Shade refers to dappled sunlight with no direct sun (Wasowski, 29). Existing vegetation, fences, walls, buildings and slope can all affect light exposure and should be noted.

Soil Moisture

There are four classifications of soil moisture: wet, moist, moist to dry and dry. Soil moisture can vary on a site, so make note of different areas. Also, one must take into consideration recent rain events or dry periods. Wet refers to soil that is consistently or frequently inundated with water. This includes wetland areas but not areas that hold water for a brief period of time after a rainfall. Moist soil is defined as soil that retains moisture year-round. This soil type is ideal for most plants. Moist to dry soil is seasonally moist but is also periodically dry. Dry soil has very little to no moisture and is typically found in sandy soils (*Landscaping with Native Plants in Tennessee, TN-EPPC*) (Wasowski, 29).

Slope

If a topographical survey is not available, slope can be difficult to determine by a site visit alone. Slopes less than 10% (10H:1V) are generally flatter and may have areas that hold water. Slopes 10–25% (10H:1V to 4H:1V) are moderate and more prone to erosion. Slopes greater than 25% (4H:1V) are steep and pose a greater risk of erosion and may require stabilization. If slopes vary throughout the site, indicate the different areas on a map. Note any areas that require erosion prevention measures.

Waterways

These include any streams, creeks, rivers, lakes and other bodies of water. Make note of these features even if they are intermittent or ephemeral.

Existing Plant Species

Make note of the site's existing vegetation and its condition. Existing vegetation is a good indicator of a site's relative health and ability to sustain future landscaping enhancements. Note the existing vegetation characteristics, such as mature forest, transition vegetation, turf, flowering, fruit-bearing, evergreen, deciduous, invasive, etc. Record any specimens that are to remain.

Structures**Drainage Structures**

These include built structures for the purpose of collecting and/or conveying water. Document all drainage structures, including inlets, headwalls, culverts, swales, and detention and retention ponds. Note features about each structure, including sizes and materials.

Utilities

All existing overhead and underground utilities should be documented. If a survey of underground utilities is not available, contact local utility companies to locate all underground gas, water, electrical, sewer and storm water lines. Indicate other utilities that will require access, such as control boxes and manholes. Prior to construction, contact Tennessee One Call System, Inc. (1-800-351-1111 or 811) to assist in locating underground utilities.

Other Structures

Document all other built features, including poles, guardrails, fences, noise barriers/sound walls, bridges, signs and billboards. Include relevant information such as their size, quantity and material.

QUICK FACTS

The colors of the paint and flags used by the Tennessee One Call System to indicate buried utilities are:

Red: Electric

Orange: Communications, Phone/ CATV

Blue: Potable Water

Green: Sewer/Drainage

Yellow: Gas/Petroleum Pipe Line

Purple: Reclaimed Water

White: Premark site of intended excavation

Source: Call 811 (www.call811.com)

Safety and Design Requirements

Clear Zones

Note the required clear zone(s). The desirable clear zone varies depending on roadside geometry (side slopes), speed and traffic volume, as well as the presence of guardrails and other barriers (Figure 1.2). Consult AASHTO's *Roadside Design Guide* (Chapter 3) and the TDOT Design Division for clear zone requirements.

Sight Distance

Note approaches and intersections that will require open sight lines (Figures 1.3 through 1.6). Record the types of roads, (major, minor, etc.) the speed limits on all roadways, and consult AASHTO's *Guide for Geometric Design* and the TDOT Design Division's Roadway Standard Drawings for sight distances and requirements.

Special Conditions

Viewsheds

Views can be something to screen or to open. Record any undesirable views that should be blocked from the roadway. Likewise, document areas that want views to the roadway blocked (e.g., neighborhoods). Note any views that should be opened or maintained. These could be scenic overlooks or views into a downtown area.

Cultural and Historical Features

Record any features of cultural or historical importance, including items that may be on the National Register of Historic Places. State parks, monuments, cemeteries and historic homes are all examples of features that should be noted.



Views, like this one from Highway 421 in Shady Valley, Tennessee, should be preserved

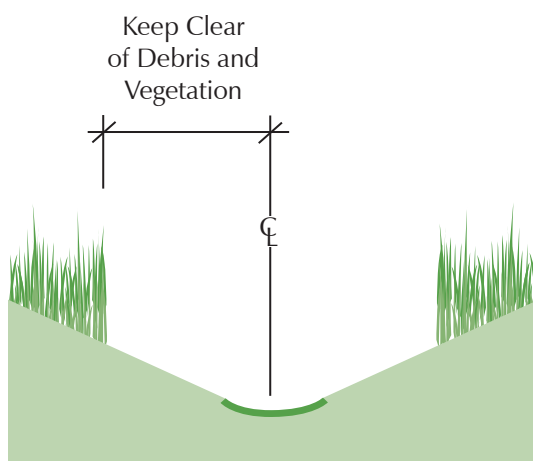


Historic structures, such as Two Rivers Mansion in Nashville, Tennessee, should be noted in the site inventory

SITE ANALYSIS: IDENTIFYING OPPORTUNITIES AND CONSTRAINTS

Now that all of the site features have been documented and the information has been gathered, it is time to analyze the findings. This analysis does not create a design, but it does guide it. The guidelines below, which are based on AASHTO and TDOT’s design, safety and maintenance policies, will help identify opportunities and constraints that may exist on any given site.

Figure 3.4: Concrete or Grass Swale



- Drainage structures must be kept clear of debris and vegetation to allow for water flow and access. Swales should be cleared or mowed a minimum of 3 feet from the centerline (Figure 3.4). All drainage structures must be kept easily accessible for maintenance.
- Certain types of vegetation, particularly trees with extensive root systems, should not be planted over underground utilities. In the roadside environment, underground drainage lines are often present and should be avoided.
- Do not plant vegetation that will interfere with overhead utilities. Only small trees or shrubs that will not exceed 25 feet at maturity should be planted under overhead utilities to prevent future interference. Consider the spread of the tree, as well, when planting adjacent to overhead utilities. Limbs that get too close to overhead lines will be trimmed.

Figure 3.5: Mature Size of Tree at Power Lines

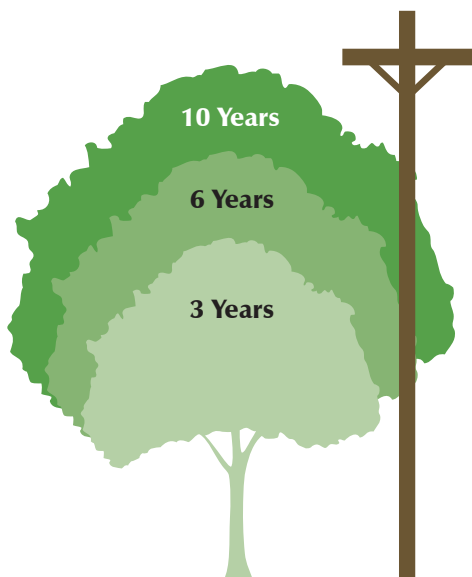


Figure 3.6: Spread of Tree at Power Lines

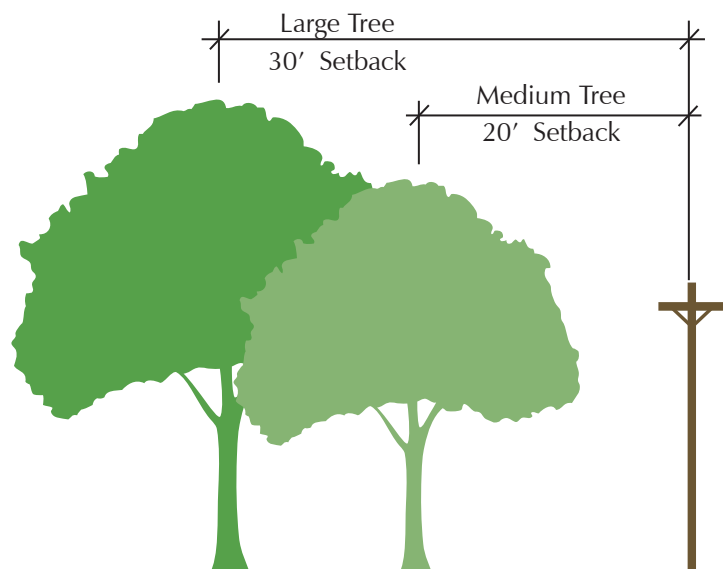
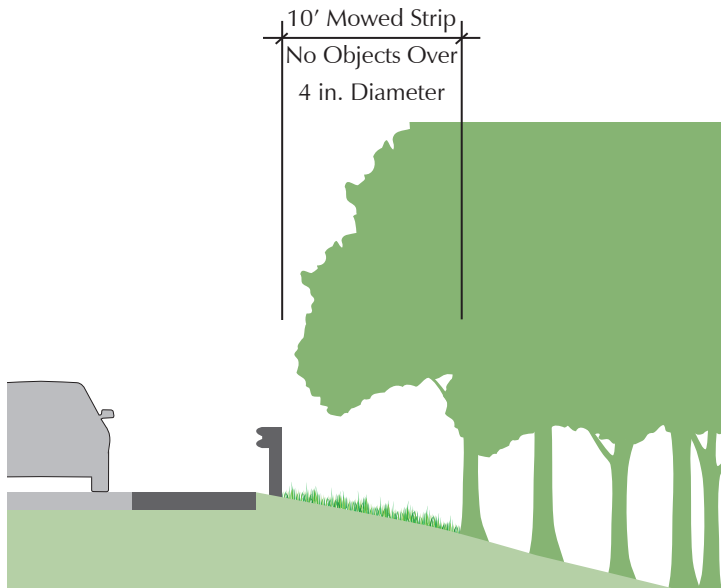


Figure 3.7: Clear Area Behind Guardrails



- There are limitations for planting behind guardrails due to safety requirements, the ability of plants to thrive and maintenance needs. If a guardrail is impacted, it deflects. This deflection distance varies depending on the guardrail system. Due to this deflection, objects over 4 inches in diameter should be kept a certain distance behind guardrails (see AASHTO's *Roadside Design Guide* for deflection distances). In addition, the soils adjacent to guardrails typically have high gravel content from construction and are not optimum for tree growth. Therefore, trees should be planted a minimum of 10 feet from the back of guardrails. Another consideration is maintenance. A 10-foot mowed strip should be maintained behind guardrails in order to keep them functioning properly and to prevent vegetation from growing in guardrail posts.
- In medians, consider the available width for plantings and choose plants that will not overhang the roadway shoulder. In some cases, medians may be too narrow for trees, and only shrubs, grasses or flowers should be used.
- Cultural and historic resources may be something that should be protected and restricted from access (e.g., burial grounds), or something to be preserved, enhanced, viewed and/or open to the public (e.g., parks, historic homes).
- In areas where sight distances must be preserved, leave a clear sight window from 3.5 feet to 8.5 feet above grade (Figure 1.3).

- Vegetation should not interfere with lighting, which is necessary for night visibility.
- Views can be screened from or to the roadway with vegetation, earthen berms, fences, walls, or a combination of these items. Conversely, views can be opened or preserved with removal and regular maintenance of vegetation.
- Vegetation cannot obstruct views to signs and billboards. On high-speed roads, such as interstates and highways, signs require a minimum clear area of 500 feet for visibility (TCA §54-21-119). On lower speed roadways, any vegetation that obstructs signs should be cleared from the motorists' line of sight (e.g., tall grasses or shrubs, low-hanging tree branches). Billboards require the right-of-way to be clear of vegetation that obstructs views to the sign, but only up to 500 feet within the area of general visibility. However, this only applies to new vegetation or vegetation that has grown since the installation of the billboard. In other words, existing vegetation cannot be removed after the installation of a billboard.

Figure 3.8: Clear Area at Signs

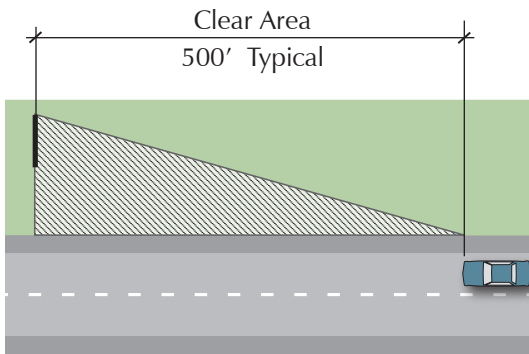
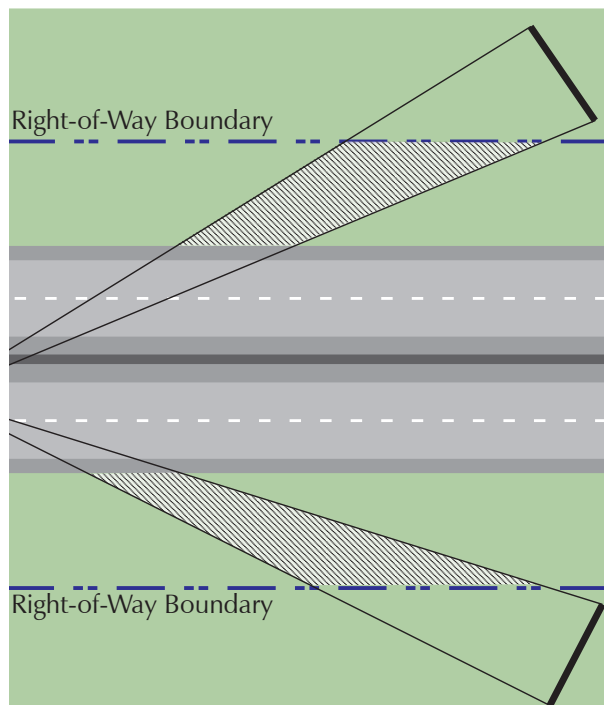


Figure 3.9: Clear Area at Billboards



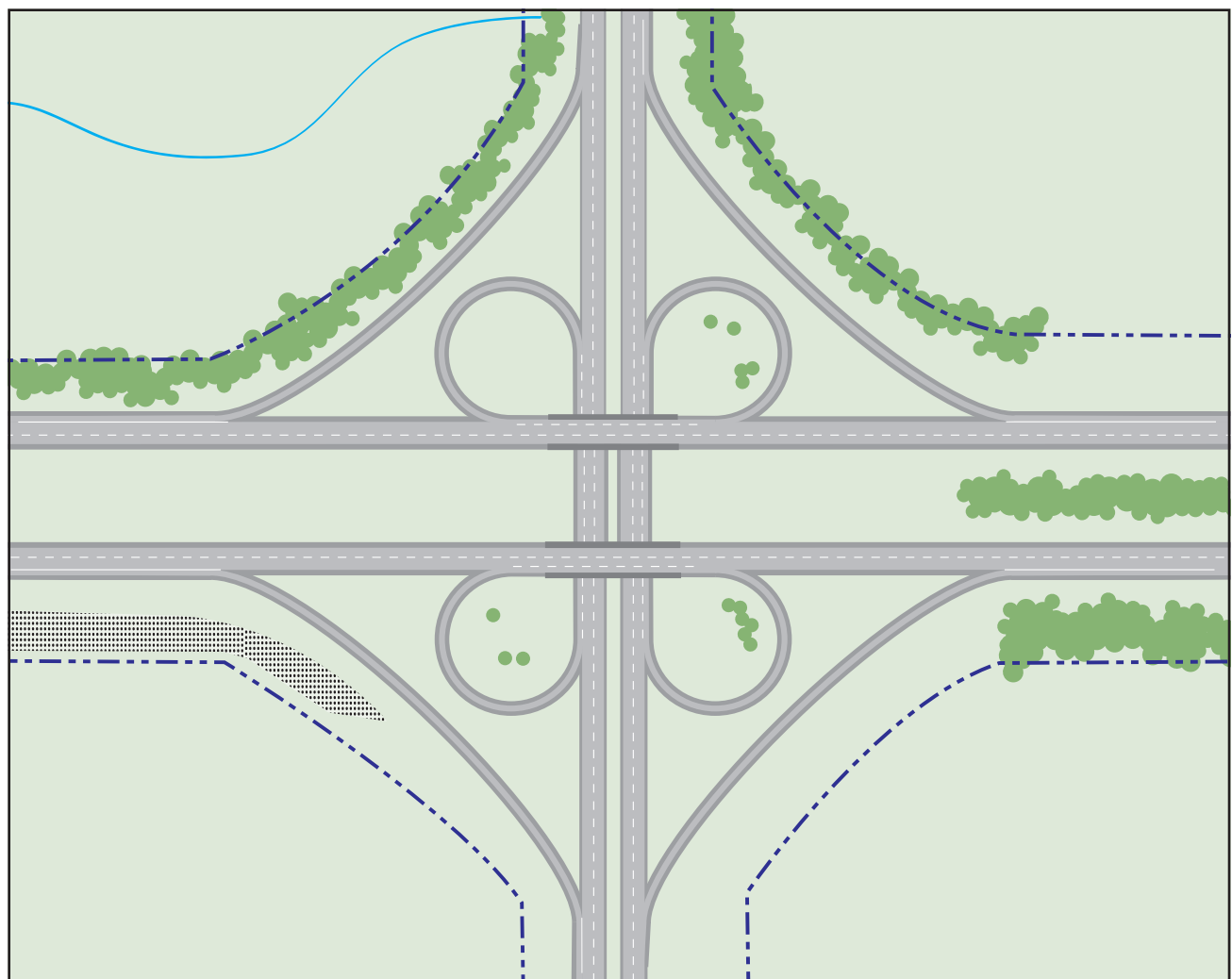
SITE INVENTORY AND ANALYSIS EXAMPLE

As the pieces come together, opportunities and constraints are revealed. Areas in which to plant or not to plant, the type of vegetation and materials to use, and views to be screened or preserved are all identified. Figure 3.17 illustrates the end product of a thorough site inventory and analysis.

Existing Environmental Conditions

In this sample project site, there are several large stands of existing vegetation within the right-of-way. The design speed for both roadways is greater than 45 mph. A creek runs through a field in an adjacent property to the northwest before it enters a headwall and is channeled under the roadway. Steep slopes to the southwest of the interchange present a challenge for mowing equipment and some erosion is apparent. Otherwise, the overall landform in the medians and interchange is flat to moderate with slopes up to 15%.

Figure 3.10: Existing Environmental Conditions



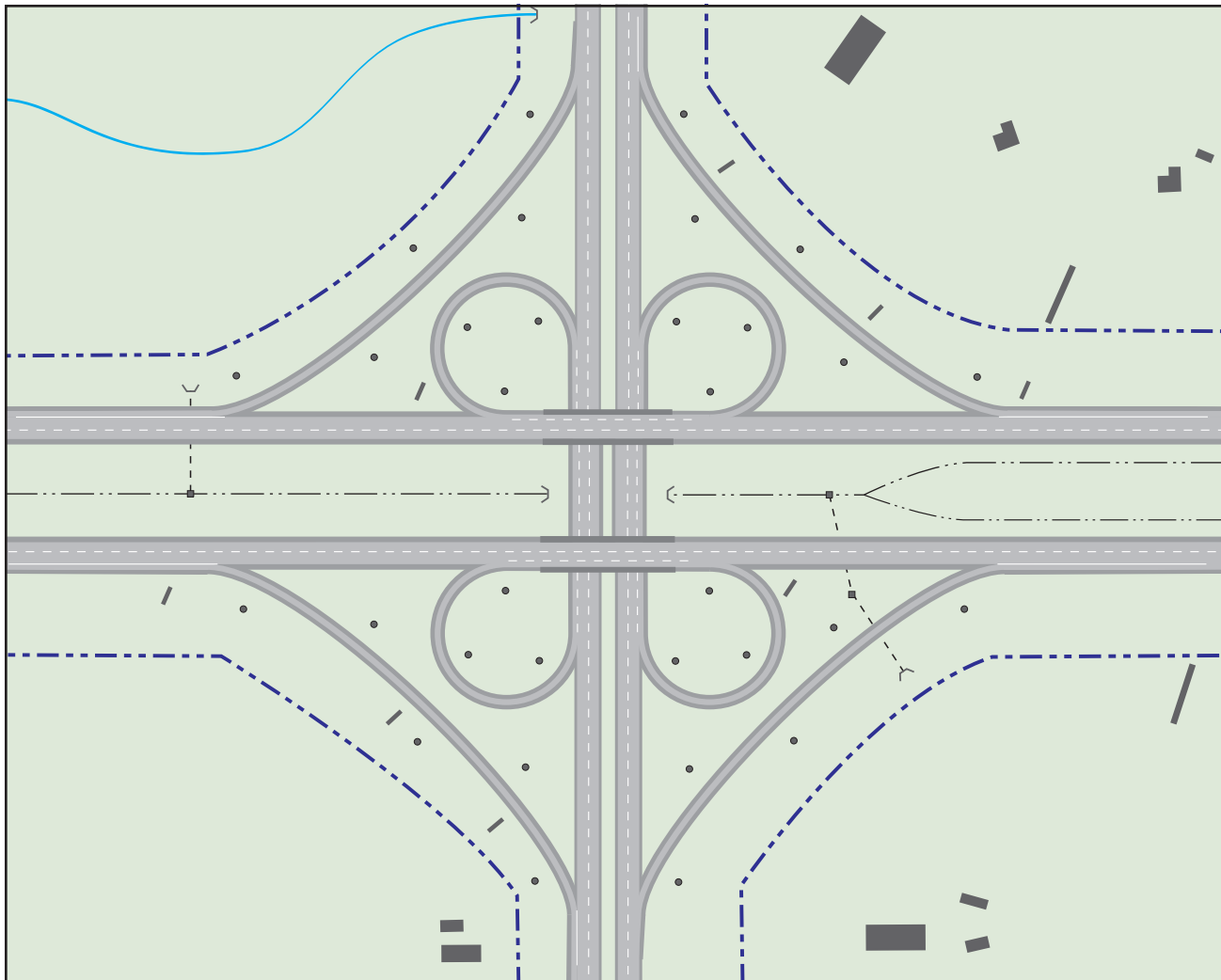
Legend

- Right-of-Way Boundary
- Stream
- Existing Vegetation
- Steep/Eroding Slope











Existing Structures

Several light posts, signs and drainage structures are present throughout the interchange. The drainage structures include inlets, headwalls and underground pipes. Two billboards are also present on adjacent properties to the northeast and southeast of the interchange.

Figure 3.11: Existing Structures



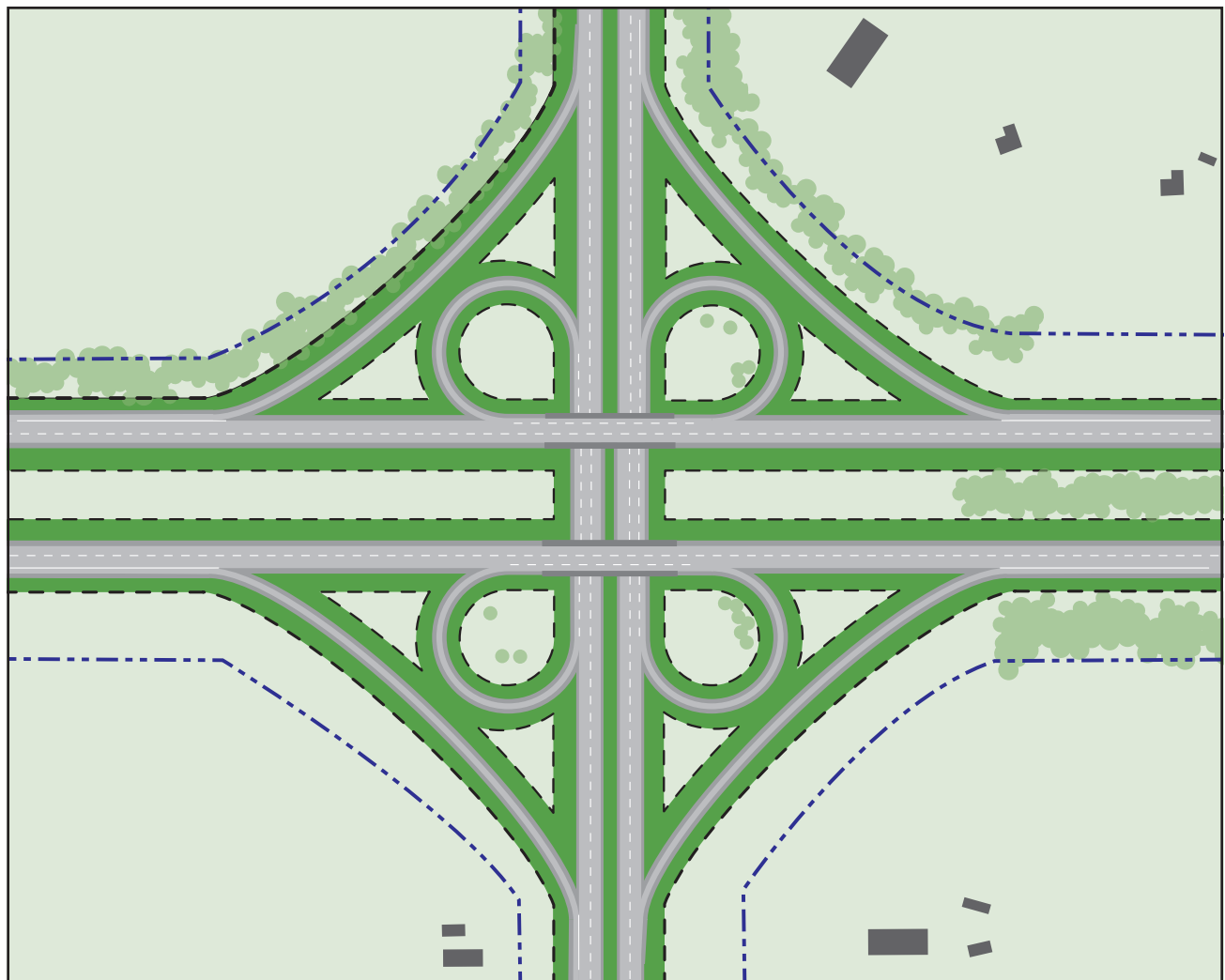
Legend

- | | | |
|---|---|--|
|  Right-of-Way Boundary |  Swale |  Sign |
|  Stream |  Underground Drainage Line |  Building |
|  Drain Inlet |  Light Pole | |
|  Headwall |  Billboard | |

Clear Zone

The desirable clear zone is illustrated (refer to Figure 1.2). This area must be kept unobstructed in order to allow a driver to stop safely or regain control of a vehicle that leaves the traveled way. On roadways with design speeds less than 45 mph, consult the TDOT Design Division for engineering guidance of site-specific clear zone requirements. On roadways with design speeds of 45 mph or greater, only turf, native and ornamental grasses, and flowers are appropriate vegetation choices for the clear zone.

Figure 3.12: Clear Zone



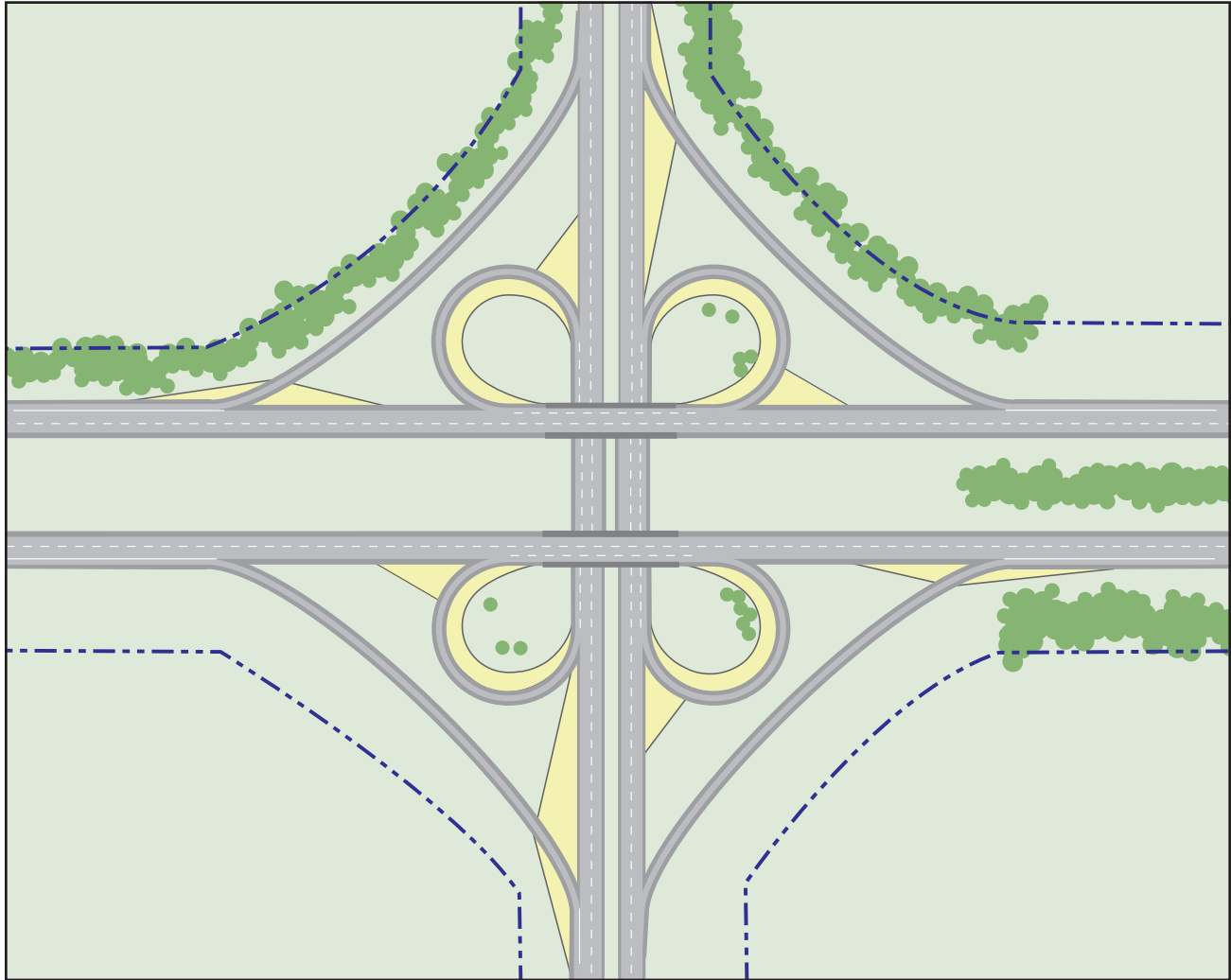
Legend

- Right-of-Way Boundary
- Clear Zone
- Existing Vegetation

Sight Distance

The desirable sight distances are shown at intersections and areas where vehicles must merge into traffic lanes. These areas must be kept clear of sight obstructions (refer to Figures 1.3 through 1.6).

Figure 3.13: Sight Distance



Legend

--- Right-of-Way Boundary

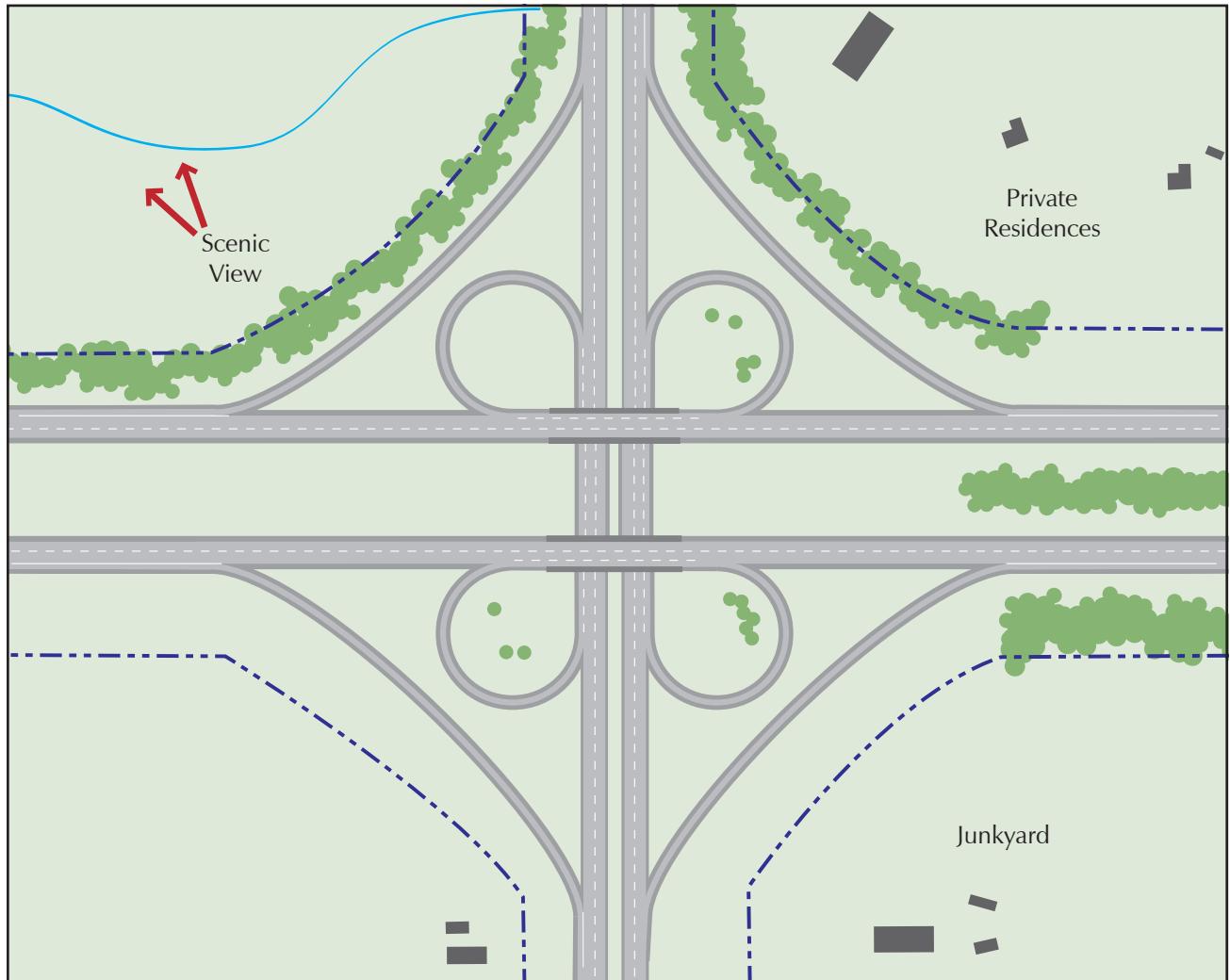
□ Areas Free of Sight Obstructions

Existing Vegetation

Special Conditions

A mountainous area to the northwest offers a spectacular scenic vista, but existing vegetation blocks the view. Residences on adjacent properties to the northeast wish to preserve privacy and want views to the roadway blocked. A junkyard on the property to the southeast is unsightly and should be blocked from view.

Figure 3.14: Special Conditions



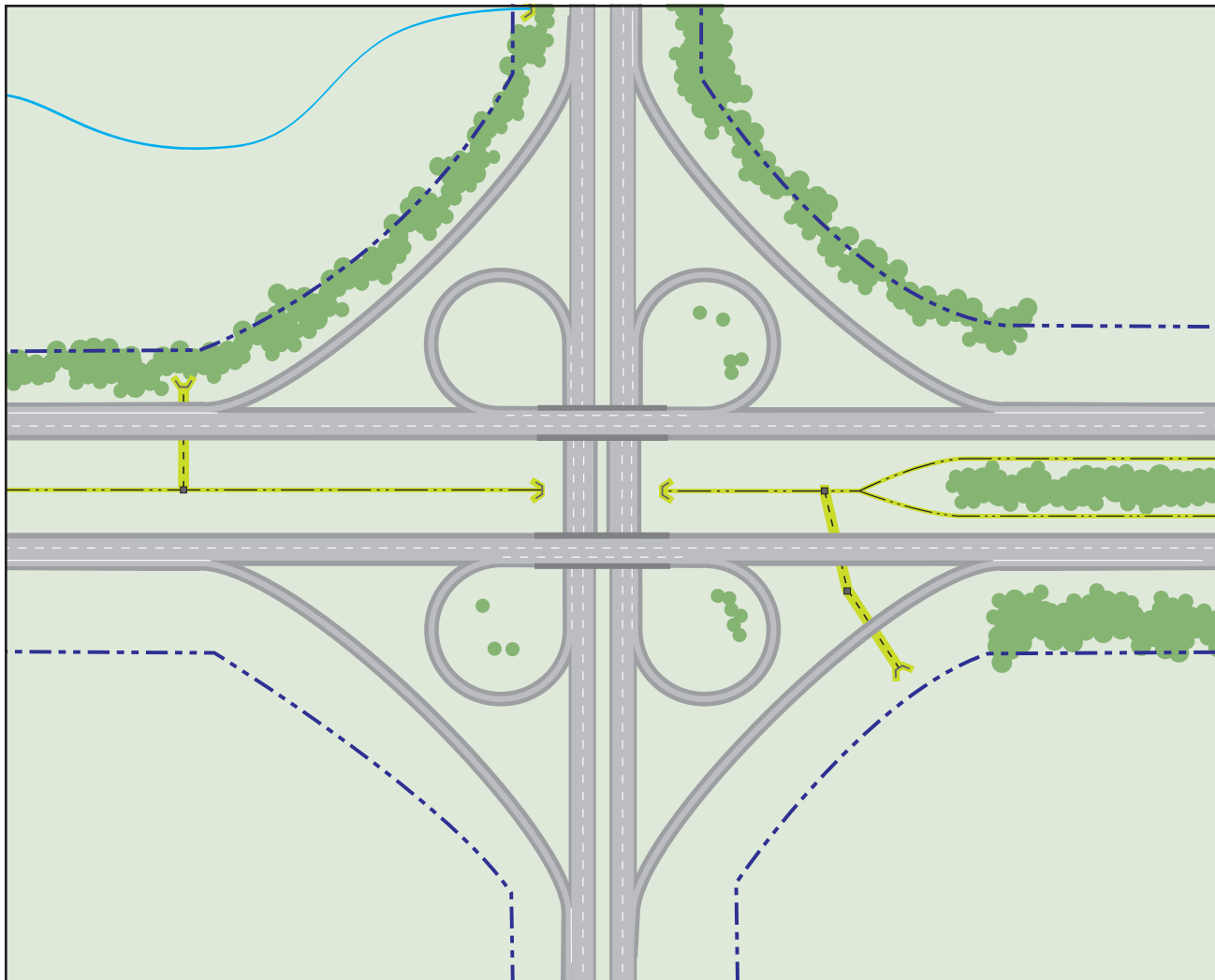
Legend

- - - Right-of-Way Boundary
- Existing Vegetation
- Building

Drainage Structures

Vegetation should not be planted within drainage swales, and trees should not be planted over underground drainage lines. Swales and the areas around inlets and headwalls should be mowed and kept clear of debris.

Figure 3.15: Drainage Structures



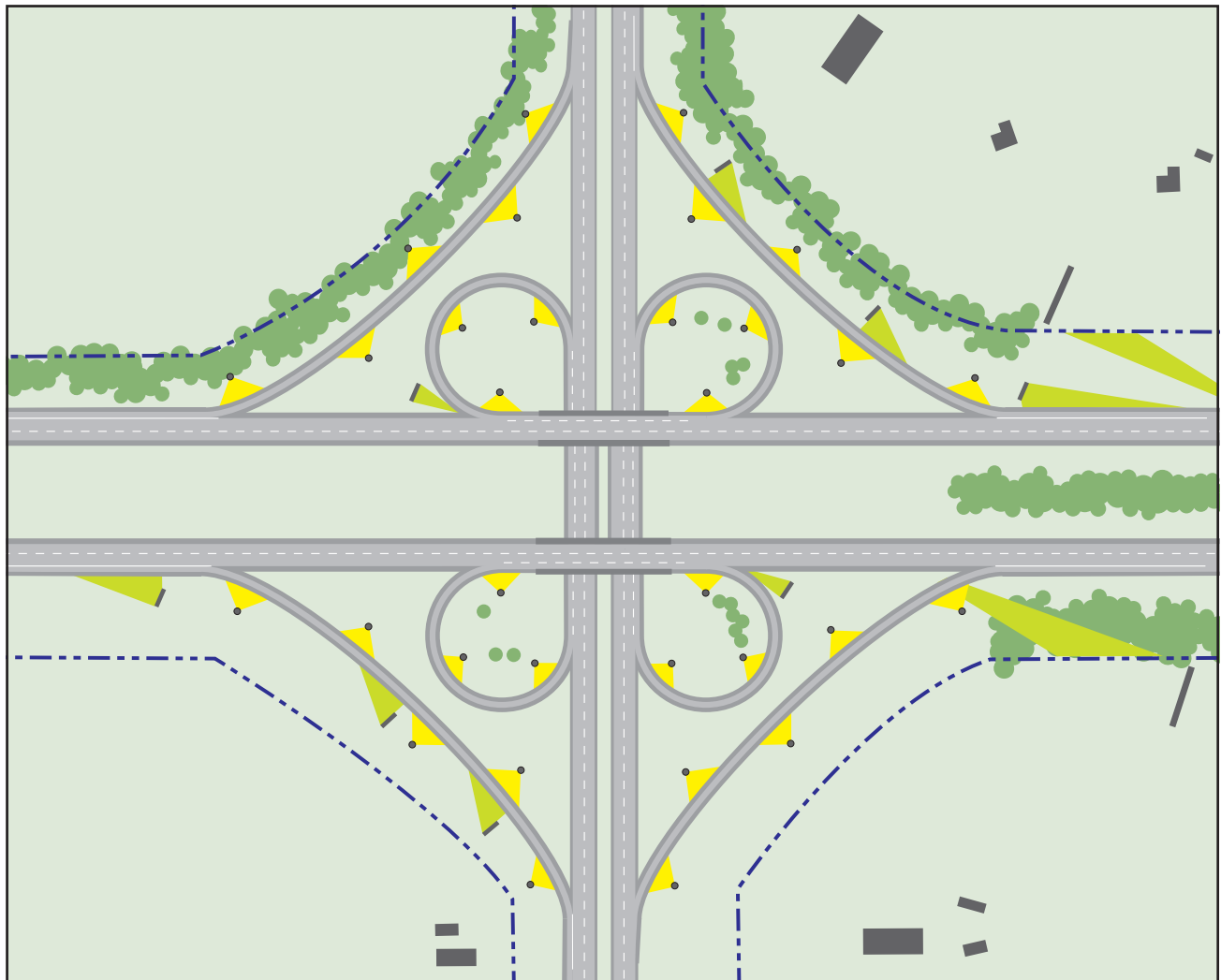
Legend

- Right-of-Way Boundary
⌋ Clear Area at Headwall
- Existing Vegetation
— · — Clear Area at Swale
- ~ Stream
- - - No Trees over Underground Drainage Lines
- Clear Area at Drain Inlet

Lighting and Signage

Avoid planting tall vegetation in areas where it will interfere with light from the light poles. Apply the rules for visibility to signage and do not plant vegetation that will grow to obstruct visibility to existing billboards.

Figure 3.16: Lighting and Signage



Legend

- - - Right-of-Way Boundary
- ▲ No Obstructions at Signs and Billboards
- Existing Vegetation
- ▲● No Obstructions at Light Poles

Final Site Synthesis

As the pieces come together, opportunities and constraints are revealed. Areas in which to plant or not to plant, the type of vegetation and materials to use, and views to be screened or preserved are all identified. Figure 3.17 illustrates the end product of a thorough site inventory and analysis.

The areas shown in yellow indicate should be free from sight obstructions. This includes views to existing signs and required sight distances. Vegetation that is 2 feet tall or less, such as low growing shrubs, grasses or ground covers are appropriate for these areas.

The areas shown in blue indicate views to existing billboards. When selecting vegetation for these areas, do not use plants that will grow to obstruct the view of the billboard.

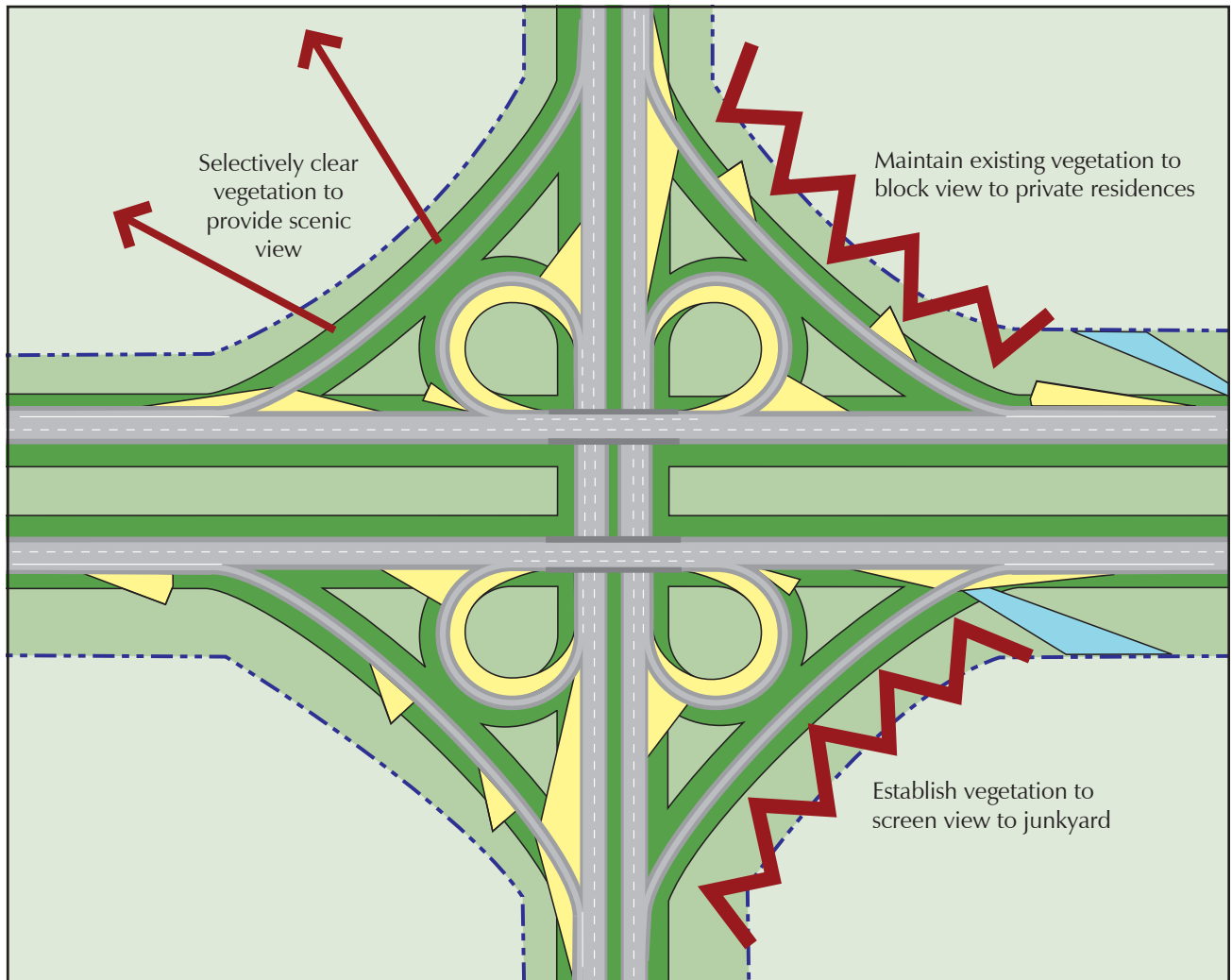
The clear zone is indicated by dark green. In this scenario, turf, native and/or ornamental grasses, or flowers are appropriate vegetation choices for the clear zone. In areas where the sight line triangles (shown in yellow) overlap the clear zone, the clear zone criteria still apply.

The steep, eroded slope requiring stabilization is shown in brown. There are a variety of methods for stabilizing a steep slope (e.g., terraces, erosion control blankets, riprap, vegetation). In this scenario, selecting a low growing shrub or ground cover (e.g., creeping juniper, cotoneaster) may help stabilize the slope. Since this particular sample project site notes that mowing the slope is a challenge, grasses should be avoided.

The views to the private residences and the junkyard should be screened by either maintaining existing vegetation or establishing a new vegetative buffer. The view to the mountains should be opened by selectively removing vegetation.

The areas shown in light green present the most opportunities. The existing drainage structures must be avoided, but the type and size of vegetation used in these areas is less restricted.

Figure 3.17: Final Site Synthesis



Legend

- Right-of-Way Boundary
- Vegetation 2 ft. tall or less
- Vegetation that will not grow to obstruct billboard
- Any vegetation (avoid drainage structures)
- Turf, native and/or ornamental grasses, and/or flowers
- Slope stabilization needed
- Block/Screen View
- Open/Preserve View

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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

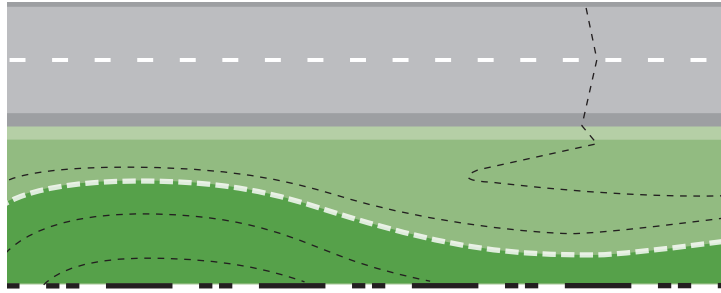
should follow the topography and run parallel to the contours. To create interest in a landscape with no variation in topography, use a curvilinear planting and/or mowing pattern to add depth. Gradual and non-uniform curves, similar to a low frequency wave, that follow land form and natural features, 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.

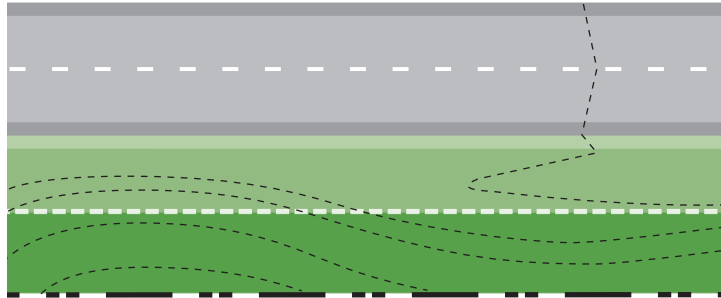


Curvilinear lines can soften a linear landscape and add visual interest to the roadside environment

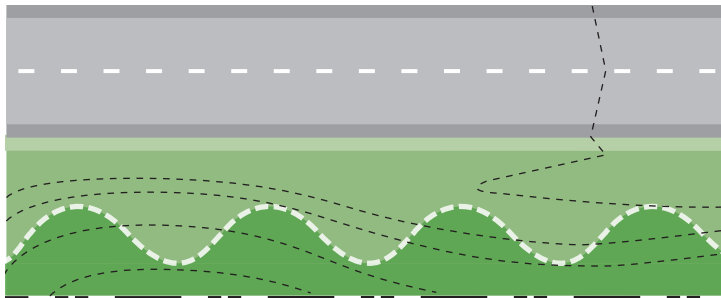


----- Contour Lines (Land Form)

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



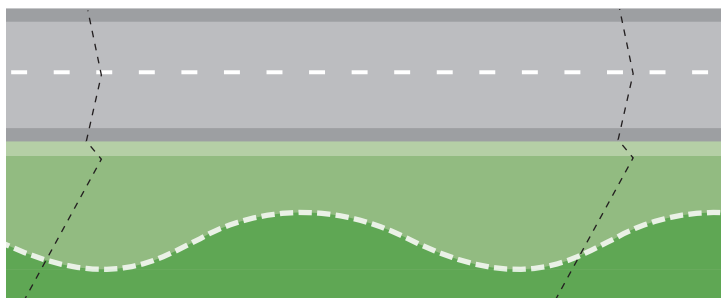
✗ The straight edge does not follow topography and is more difficult to maintain/mow



✗ 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

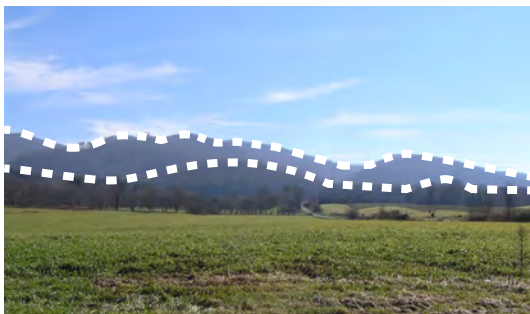
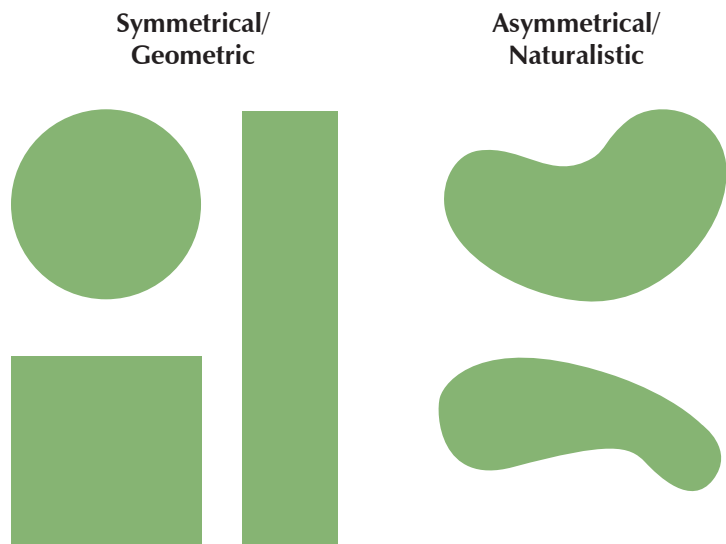


✓ A “low frequency” of gradual curvilinear line creates interest in a roadside environment with little topographic variation

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* 'Dawyckii' 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*)

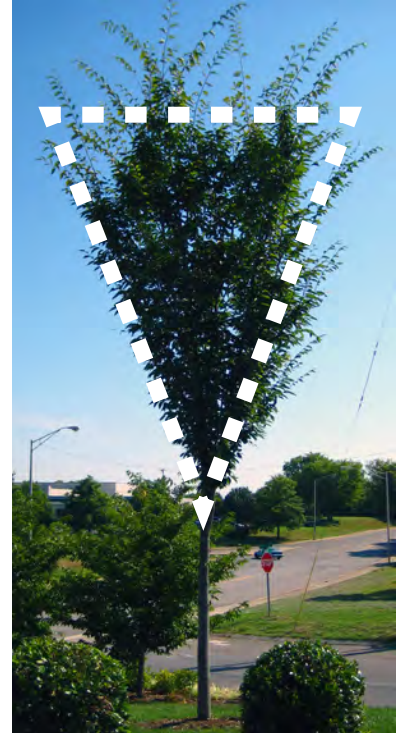


Weeping

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



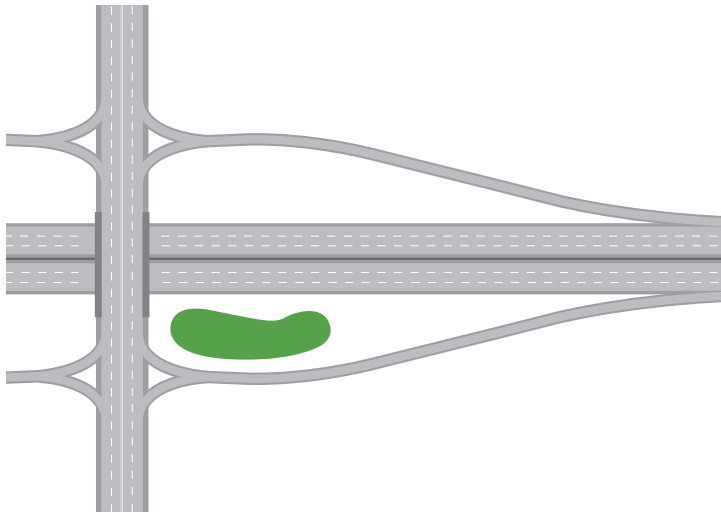
The width of the planting bed or mulched area is one third (1/3) the height of the tree



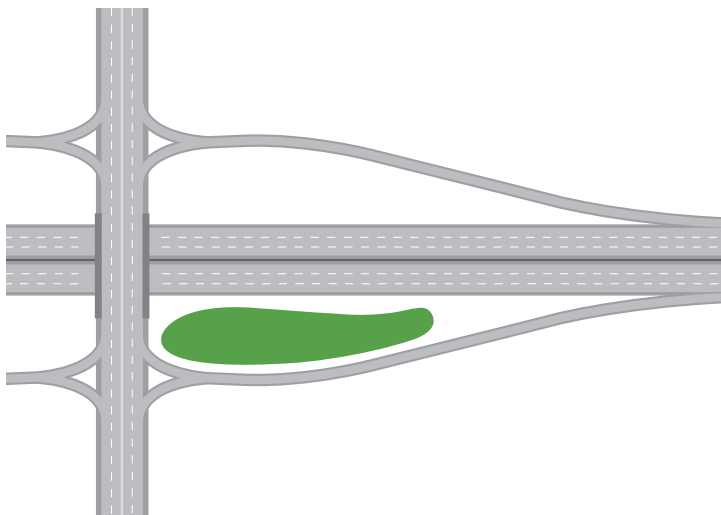
Planting bed width is three times the height of the tallest plant



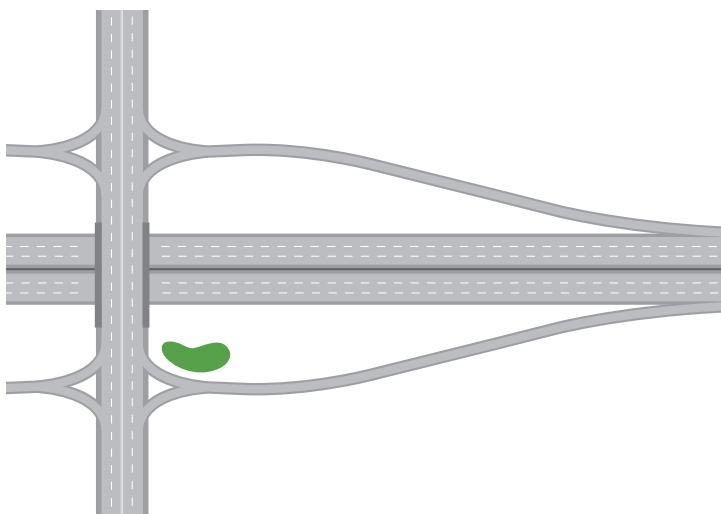
Planting bed width is three times the height of the tallest plant



✓ 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.



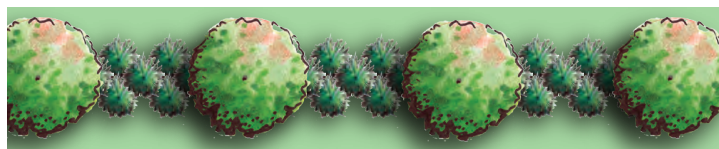
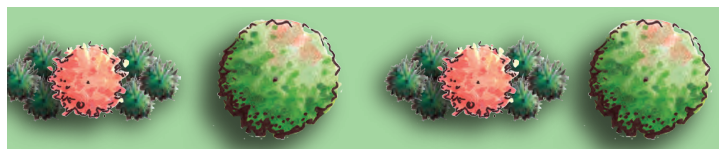
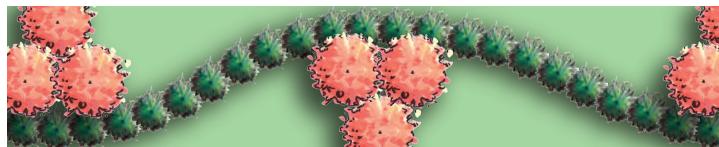
Balance created by trees of different species but equal height on both sides of the roadway

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.

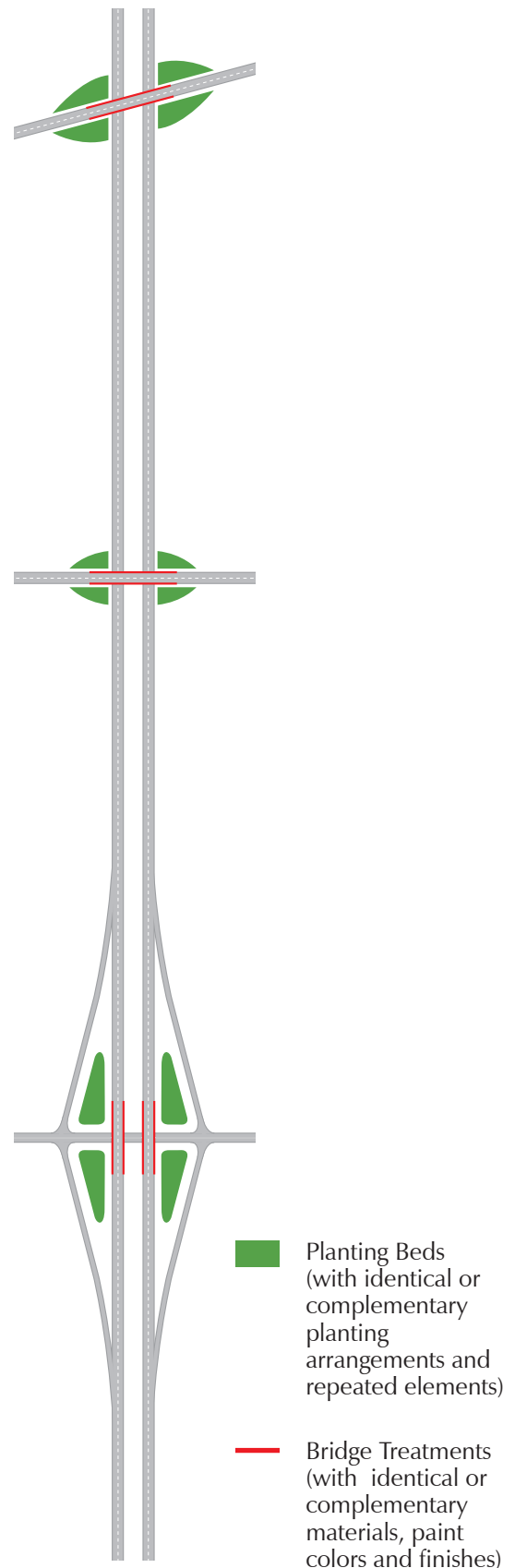


Formal patterns can be created by repeating identical plant materials and using consistent spacing



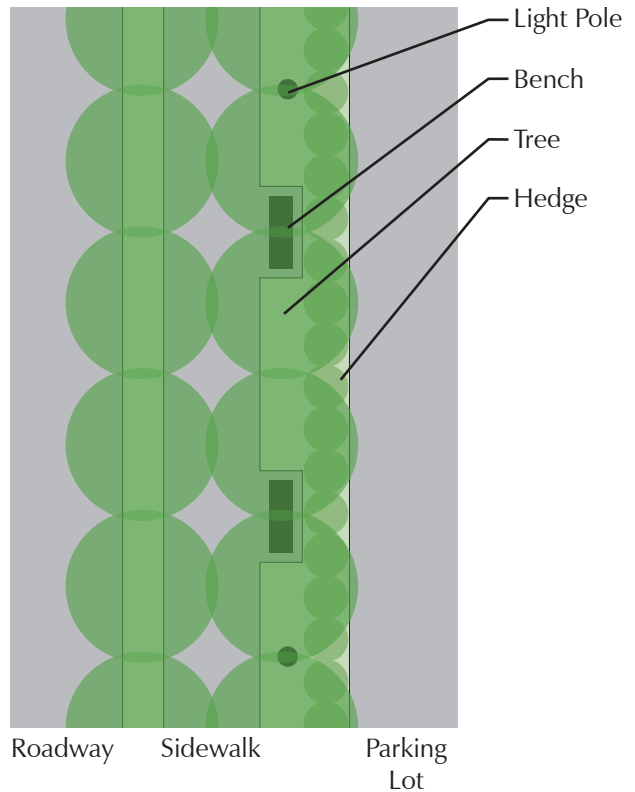
Pattern can be created along a right-of-way with an existing tree line by planting masses of identical plant materials at regular intervals

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



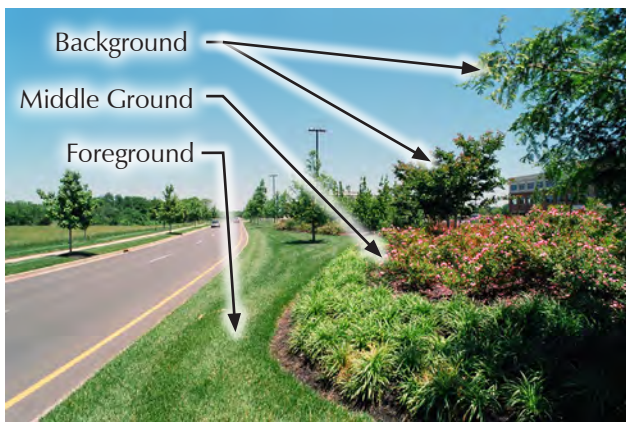
Use grasses or other low-growing vegetation to preserve views, like this interchange at exit 50 on Interstate 81 in Washington County



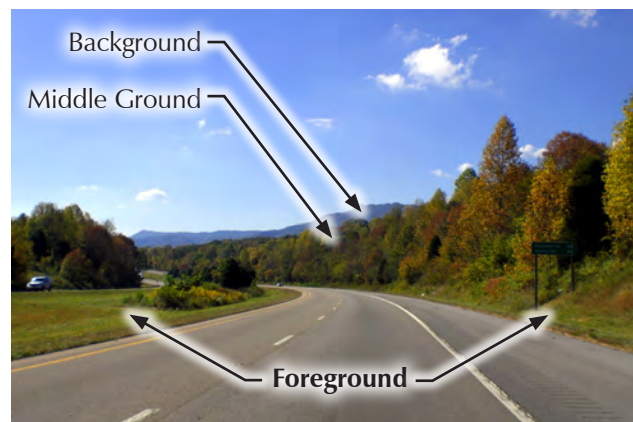
Depth can be created by using a variety of flowers, ground covers, ornamental grasses, shrubs and trees of different heights

Depth

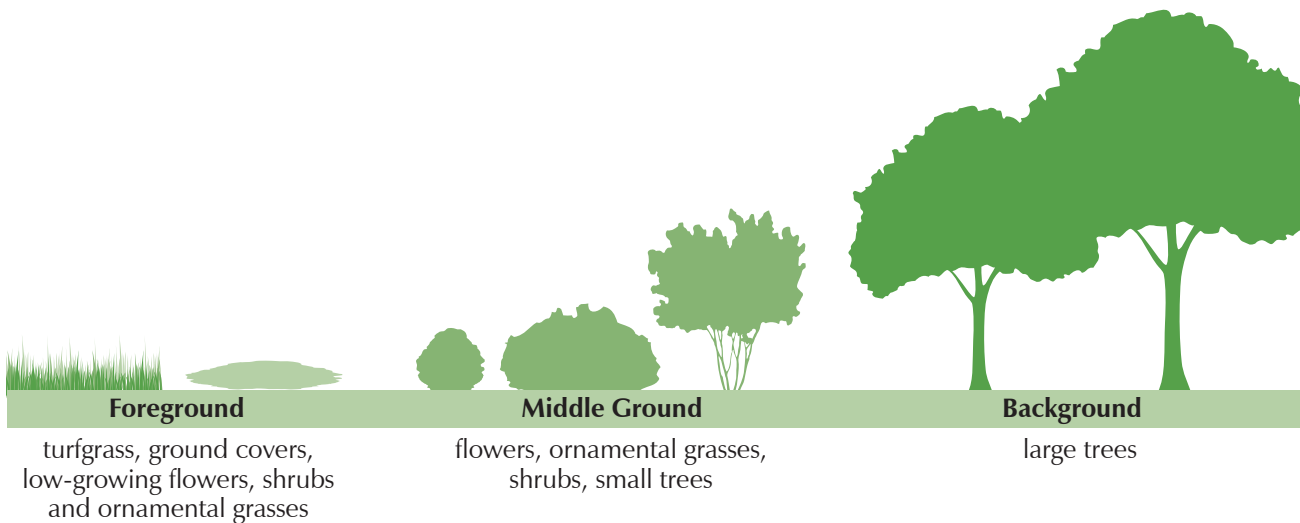
Depth is established by defining a clear *foreground*, *middle ground* and *background*. Foreground refers to the objects closest to the viewer. At a smaller scale, this is typically low-growing vegetation like turfgrass, flowers or ground covers. Middle ground refers to the objects behind the foreground; 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.

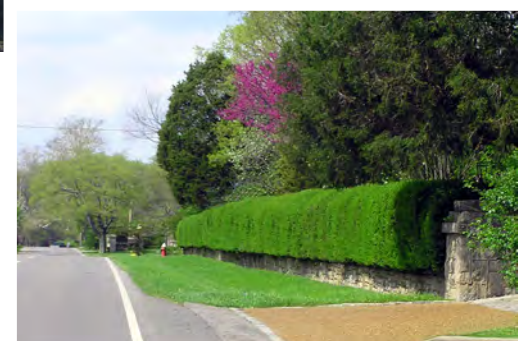
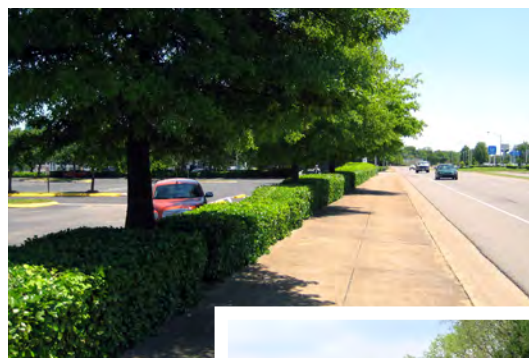
	Ornamental Quality in Fall/Winter			
	Flowers	Berries	Foliage	Stems
Wintersweet (<i>Chiomonanthus praecox</i>)	●			
Tatarian Dogwood (<i>Cornus alba</i>)				●
Redosier Dogwood (<i>Cornus sericea</i>)				●
Forsythia (<i>Forsythia x intermedia</i>)	●			
Dwarf Fothergilla (<i>Fothergilla gardenia</i>)			●	
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, liriope 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.



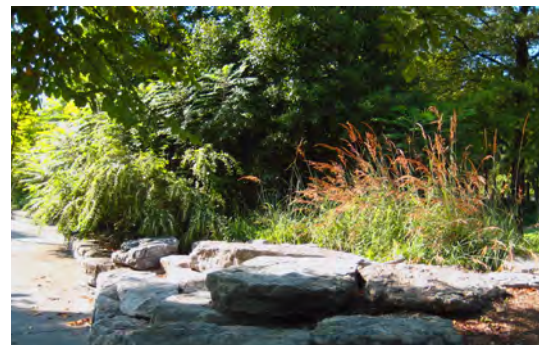
Modular block can be made to resemble real stone by using various textures and color additives

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)



Colored and stamped concrete sidewalk

Colored Concrete

Colored concrete is acceptable in all landscape classifications and applications and is often used in conjunction with stamps or molds. The color should be chosen to complement the surroundings but can also be chosen based on a unique characteristic of a community, such as local school colors.

Color can be applied on the surface, integral with the concrete, with pigments or dyes, and with paint. The color application method depends on whether it is a horizontal or vertical surface, and each method provides different degrees of color vibrancy and permanence. Painting concrete provides instant visual impact. However, long-term maintenance can become an issue as color may fade or chip over time.



This mural, painted on a concrete retaining wall along Jefferson Street near Interstate 40 in Nashville, Tennessee, honors a piece of local history—the Fisk University Freedom Riders

Veneers

Veneers are applied to an existing vertical surface using a cement stucco or mortar mixture. Veneers are not structural, but can be applied on walls, bridge abutments and other vertical surfaces. They come in a variety of patterns, but manufactured stone is one of the most popular veneers on the market. Manufactured, or cultured, stone is made to resemble natural stone by casting concrete in molds and adding pigments.

Applying a veneer to an existing wall has benefits, including design flexibility and cost. Stone sizes and patterns can be varied, and manufactured stone costs less than natural stone.

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

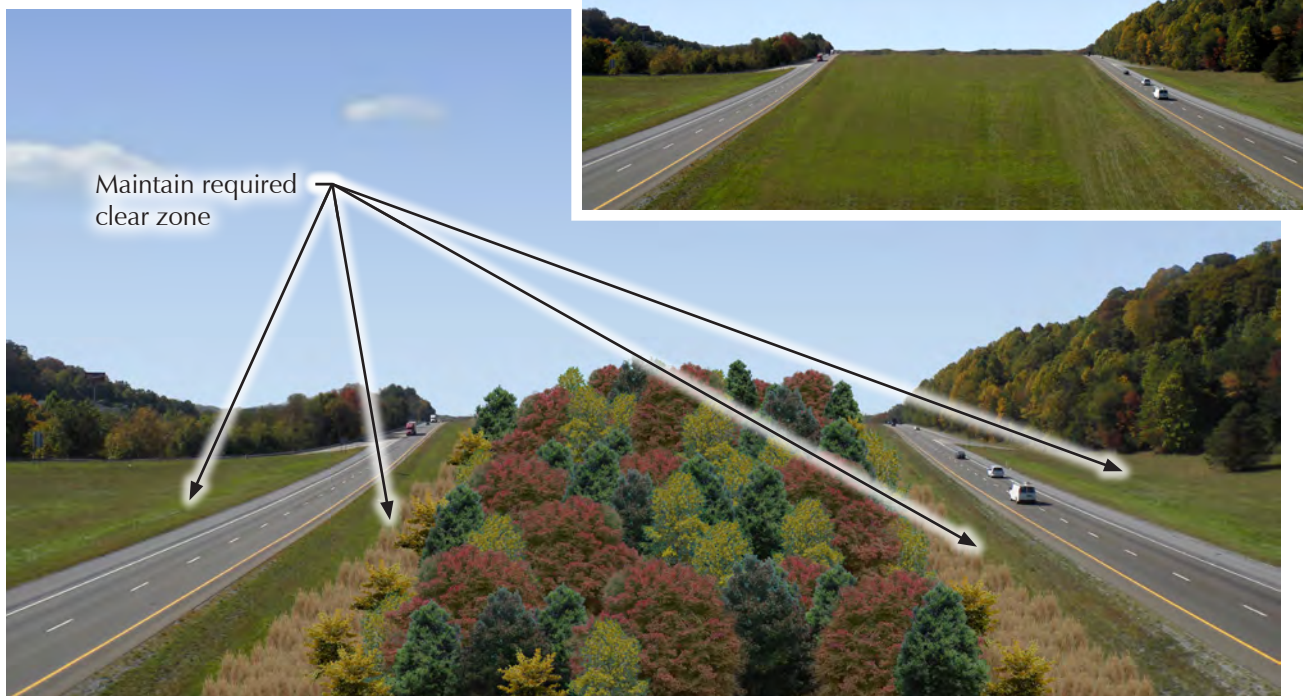
(i.e., background, middle ground and foreground) and create masses of color or texture by either removing or adding plant material.

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



CHAPTER 6

SAMPLE DESIGN SOLUTIONS

The guidelines throughout this manual explain the fundamentals of designing within the roadside environment. They illustrate how to maximize aesthetics and environmental benefits through maintenance practices and the selection and placement of plant and hardscape materials. This chapter applies the guidelines of this manual to hypothetical scenarios that will be encountered in various landscape classifications and types. The design solutions in this chapter are provided as examples of the design process described throughout this manual. They are not intended to be copied into similar situations.

Example design solutions have been provided for the most common roadside landscape types: interchanges, rights-of-way and intersections. Each solution responds to the site constraints and opportunities, but shows the flexibility that can be achieved in a seemingly constrained roadside environment. In each classification, at least two solutions are presented for each landscape type showing an ornamental, naturalized or monoculture design. Some design solutions show methods of improving existing landscapes with minimal intervention. These examples offer perspective on the quality of design that can be achieved with different levels of maintenance and funding resources.

Following the design solutions for common roadway landscape types are examples of how to apply the guidelines of this manual to highway facilities, scenic roadways, streetscapes and gateways.

DESIGN CONSIDERATIONS

Interchanges

A well-designed interchange provides curb appeal that reflects a positive image of an entire community. Interchanges are typically points with higher volumes of traffic that allow motorists time to experience the roadside environment. Interchange enhancement projects should not be distracting, but do not have to be featureless. A clean and simple approach to design is very effective.

Interchange and overpass landscaping should not obstruct scenic vistas or views to features like city skylines. Low-growing shrubs, grasses or perennials should provide a

foreground for the view. Small trees may also be appropriate at the bottom of steep slopes to create the foreground.

Urban interchanges can present many challenges. The nature of the urban landscape is diverse, so urban interchanges and their design treatments can be very unique. Urban interchanges are often contained in a smaller area of land compared to suburban and rural interchanges, which affects the size and type of plant materials used in a design, as well as the maintenance practices.

Suburban and rural interchanges often occupy large areas of land and offer a greater flexibility in design. When designing the interchange landscape, use ground covers, low-growing shrubs, grasses and perennials to create an attractive foreground. Small evergreen and flowering trees may be used in the interior spaces of the interchange to provide a middle ground, while larger trees species provide the background.

Interstate Right-of-Way

Interstate right-of-way widths vary greatly within each landscape classification. Urban interstate rights-of-way are often minimal and can be limiting to roadside enhancements. These areas may require more creativity in design, but terraces, seat walls, alternative fencing materials and aesthetic treatments to hardscape components can be applied in narrow right-of-way corridors to enhance visual appeal.

Suburban and rural interstate rights-of-way are typically much wider than urban rights-of-way. Often the goals when designing a suburban or rural interchange are to provide an attractive screen for adjacent property owners and also to enhance the roadside appearance for traveling motorists. Larger deciduous and evergreen trees create effective visual screens. Conversely, some areas will have attractive views that should be preserved. This can be achieved through selective removal of vegetation or by planting vegetation to frame desired views.

New mowing patterns can improve aesthetics with little to no additional cost. Native or adapted prairie grasses may be used in areas outside of the sight triangles (page 1.9) to create an attractive alternative to higher-maintenance turf areas.

Fences are major visual features in the interstate right-of-way. These fences are a necessity, used as a safety precaution as well as to mark the boundaries of the right-of-way. Alternative solutions could be as easy as using powder-coated chain link or ornamental fencing. Right-of-way fences become visually distracting when they are unkempt and overgrown. Metal fences will rust and weeds can invade over time, becoming a tangle of vegetation. To prevent the growth of woody plant species at the fence line, maintain a mowed strip on either side of the fence. Allow tall vegetation to grow up to the mowed strip within the right-of-way in order to screen the fence. Managing the fence line can prevent damage and warping of the structure, which contributes to an unpleasant aesthetic.

Noise barriers are often a component in the design of urban and suburban interchanges. Plant material may be used to soften the appearance of these walls or screen them entirely where appropriate. Other treatments such as stamped patterns and paint, as described in Chapter 4, can be applied to enhance these features as well.

State Route Right-of-Way

In the urban and suburban landscape, structures, utilities and pedestrian facilities are likely to be close to or directly adjacent to the edge of the roadway. Right-of-way space is very limited along urban and some suburban state routes because of existing hardscape components, utilities and required sight lines.

Design solutions should take pedestrian and cyclist needs into consideration. For instance, placing a vegetated buffer of even a couple of feet between the roadway and sidewalk can create a safer and preferred walking environment.

Walking, bicycling and advertising are a few activities that occur more frequently within the urban and suburban state route right-of-way than in rural landscapes. Curb cuts and the presence of stop lights and utility fixtures contribute to visually cluttered corridors. The arrangement of these factors, along with plants and proper maintenance techniques, will make urban and suburban areas more appealing. For instance, repeating one or two tree species along the length of a road at regular intervals can make a visually cluttered corridor appear more orderly and create a unified appearance.

Many four-lane interstates and state routes also have wide medians. Medians in urban and suburban environments are often raised with curbs and planted with trees or shrubs, but may also function as drainage swales. Aesthetic median enhancements depend heavily on maintenance. Because medians are a focal point along roadways, litter, overgrown or unhealthy plants, improper pruning and weeds are highly noticeable. The lifespan of vegetation in a median is less than other areas due to the harsh conditions plants must endure to survive. Heat, pollution, salt and limited water can all contribute to a plant's mortality in roadway medians. Choose urban tolerant plants that require little maintenance and survive harsh conditions, especially periods of drought. Choose plants that naturally have the form you would like to achieve instead of plants that will require pruning to achieve the effect. Create large planting beds or space trees evenly and wide enough apart to accommodate a mower. Mulch thoroughly or plant ground covers to prevent mower damage to trunks and to reduce the amount of turf that must be maintained.

In the rural landscape, state route right-of-way space is usually more abundant. Design solutions should take advantage of this opportunity for additional green space. Even though rural state routes rarely have sidewalks or bike lanes, pedestrian and cyclist needs should also be taken into consideration in areas where foot traffic and cyclists are anticipated.

The presence of litter can become a problem on rural state routes. Planting taller vegetation, such as native or adapted prairie grasses, at the edge of the roadway can create a physical barrier that will contain the majority of litter close to the roadway where it can be easily picked up by state maintenance or volunteer crews.

Intersections

Several different alignments exist for intersections, as described in Chapter 2. Like interchanges, intersections are typically points with higher volumes of traffic that allow motorists time to experience the roadside environment. They are also points of decision-making and should be treated with caution when designing planting beds and signs that may obstruct sight lines. Be mindful of signage at these intersections, which can often be abundant and distracting to motorists. Signs should be designed and placed to minimize the negative visual impact on the landscape.

Community

Unique design elements can be enhanced or incorporated into a project to promote a sense of identity for a community. Creating a unique community character can attract tourism, investment, and foster a sense of civic pride. These design elements may include signage and “branding,” gateway features, standardized light fixtures and site furnishings, and other streetscape elements. Refer to the *Unique Landscapes* for more community design ideas.

Highway Facilities

Welcome Centers and Rest Areas

Most welcome centers and rest areas are found in the rural landscape classification. Design solutions at welcome centers and rest areas are most influenced by regional factors. The landscaping at these facilities must retain visibility for safety and security, but also blend into their surroundings. Other landscaping needs include providing shade for picnickers and dog walking areas.

The Tennessee Groves program, administered by the TDOT Office of Beautification in partnership with the Tennessee Urban Forestry Council (TUFC), will provide tree plantings at welcome centers and rest areas. The program was developed to accomplish a variety of goals. The primary goal is to allow donors to contribute to the beautification of the state, but it also provides an alternative to roadside memorials.

Through this program, donors can choose from one of three types of plants: shade trees, flowering trees or flowers. Individual tree species choices will be made by TDOT depending on what is regionally native to the planting site.

The first round of Tennessee Groves sites are the welcome centers on Interstate 81 in Sullivan County (Bristol), Interstate 55 in Shelby County (Memphis), Interstate 75 in Hamilton County (Chattanooga), and Interstate 65 in Giles County (Ardmore). In time, the program will be implemented at welcome centers and rest areas across the state.

Weigh Stations

Weigh stations are another common feature along interstates. Open sight lines for ingress and egress are important considerations when designing landscapes for weigh stations. Enhancements typically include foundation plantings, such as shrubs and ground covers, around the weigh station buildings.



Maintenance Compounds

Maintenance compounds can be found in all landscape classifications. From a functional standpoint, these areas must be easily accessible. Visually, their industrial nature can dominate a viewshed. Existing facilities should be screened and enhanced to blend into the surroundings to the extent possible. New projects should consider how the arrangement of multiple buildings will appear from the roadway without compromising safety or accessibility.

Unique Landscapes

Scenic Byways/Highways

Corridors designated as Scenic Byways and Highways are often two-lane roadways that traverse scenic landscapes of historical significance. Two examples are the Natchez Trace Parkway in Middle and West Tennessee and the Cherohala Skyway in East Tennessee. Scenic Byways and Highways attract tourism and are intended for recreation, education and enjoyment. They often have lower speed limits compared to other state routes and feature recreation and interpretive points of interest. Landscape improvements along these corridors should be designed to enhance the natural and cultural character of the surrounding environment. Adjacent properties that detract from the character of these landscapes should be screened from view.

Gateways

A gateway is a specific point or area along a transportation corridor that has been identified as a point of entry. Gateways can usually be found at the edge of a city or town, neighborhood or community, or they may mark a dramatic change in land use. Gateways usually have unique signage or markers and may be heavily landscaped in order to let travelers know that they have arrived in a special place. Communities usually choose to adopt specific signage standards and plant material guidelines to effectively brand these areas. Gateways may occur in all landscape classifications.

Streetscapes

Streetscape is a term used to describe the character of the space surrounding the street. The streetscape is composed of elements such as buildings, sidewalks, street trees, on street parking, plant materials, signage, above ground utilities, paving patterns, site furnishings and light fixtures. In a successful streetscape, these elements work together to create a space that is attractive to all users,

including pedestrians, cyclists and motorists. The creation of a successful streetscape requires careful planning and coordination between public entities and private stakeholders, but when completed, a successful streetscape can result in a safe and healthy environment that is attractive for all users.

DESIGN SOLUTION 1: Urban Interchange

Design Approach: Ornamental

Resources for Installation: High

Resources for Long-term Maintenance: High

Goals:

- Improve the image of the city
- Improve maintenance crew safety
- Improve air quality

Objectives:

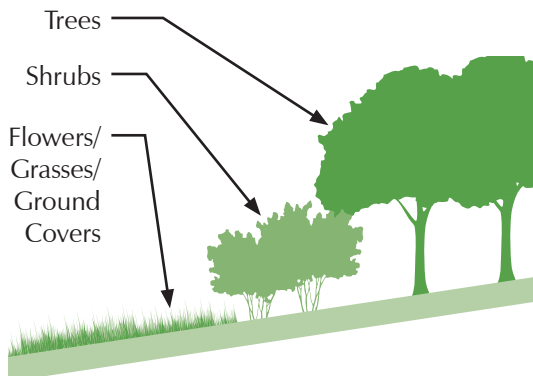
- Create a gateway into the city
- Use crisp lines and bold color
- Choose plants with ornamental qualities
- Reduce total mowed area
- Screen views to adjacent industrial properties
- Open up and/or frame views of city skyline

Vegetation:

- Urban tolerant plant species
- Large deciduous and evergreen trees for seasonal interest and to screen views
- Small flowering trees for spring and summer color
- Flowering and evergreen shrubs and flowering annuals and perennials for year-round interest
- Ornamental grasses and spreading evergreen ground cover in areas inaccessible to mowing equipment
- Turf in areas accessible to mowing equipment

Solution Summary:

This urban interchange has been identified as a primary gateway into a city. The designers decided to adopt an ornamental design approach to create a sense of arrival and a formal entrance for the city. An ashlar pattern was chosen for the face of the retaining walls to add visual interest. In addition, terracing was used to create different levels for planting along the roadway. The internal retaining walls follow a serpentine line, which creates an interesting visual rhythm.



Ornamental Approach: Create a pattern within the plant hierarchy for an ornamental appearance. Landscape installation is easily phased with a design of this type. Trees can be installed the first year and the other plant materials can be installed as funds become available.

Preserve open sight lines at intersections

Use shrubs and ground covers in areas inaccessible to mowing equipment

Use the height of plant materials to create visual interest in sloped areas



Preserve existing vegetation and supplement with masses of evergreens to screen undesirable views

Use small flowering trees to soften the appearance of large retaining walls

Create focal points with flowering annuals and perennials



Plant Material Variety: Create masses of shrubs, ornamental grasses, flowering plants and small trees in an ornamental landscape.

DESIGN SOLUTION 2: Urban Interchange

Design Approach: Monoculture

Resources for Installation: Moderate

Resources for Long-term maintenance: Low

Goals:

- Improve the image of the city
- Improve maintenance crew safety
- Improve air quality

Objectives:

- Create a gateway into the city
- Use crisp lines and rows of identical plants to lead eye towards view of city skyline
- Choose with ornamental qualities
- Reduce total mowed area
- Screen views to adjacent industrial properties

Vegetation:

- Urban tolerant plant species
- Large evergreen trees to screen views
- Small flowering trees for seasonal interest
- Evergreen shrubs and ornamental grasses to create large plant masses and provide year-round interest
- Spreading evergreen ground cover in areas inaccessible to mowing equipment
- Flowering perennials for seasonal interest
- Turf in areas accessible to mowing equipment

Solution Summary:

This is the same urban interchange as Design Solution 1. In this scenario, the project has a more modest budget for installation and maintenance but has the same goals and similar objectives. In order to achieve a similar effect, less expensive, lower maintenance plant materials are used in large masses to create a bold visual impact. Additional long-term maintenance costs are reduced by only using perennial flowering plants in the accent beds.

Preserve open sight lines at intersections

Use shrubs and ground covers in areas inaccessible to mowing equipment

Use the height of plant materials to prevent erosion and create visual interest in sloped areas



Preserve existing vegetation and supplement with masses of evergreens to screen undesirable views

Use small flowering trees to create a visual rhythm

Create focal points with flowering perennials



Strength in Numbers: Large monoculture plantings of shrubs, ornamental grasses, and flowering plants can be used to create a bold impression.

DESIGN SOLUTION 3: Urban Intersection and Right-of-Way

Design Approach: Ornamental

Resources for Installation: Moderate

Resources for Long-term Maintenance: Moderate

Goals:

- Enhance a historic neighborhood
- Improve the pedestrian experience
- Attract private reinvestment to adjacent properties

Objectives:

- Use surrounding character and building materials to make materials selections
- Choose plants with ornamental qualities
- Eliminate small turf areas that are difficult to mow
- Implement traffic calming measures

Vegetation:

- Urban tolerant plant species
- Large vase-shaped, deciduous street trees on outer edges to frame street
- Small flowering and evergreen trees in median for vertical element and to add human scale to landscape
- Evergreen and flowering shrubs, spreading evergreen and flowering ground covers, and flowering annuals and perennials for seasonal interest and to reduce mowing

Solution Summary:

This urban intersection and right-of-way is in the heart of a historic neighborhood. The designers chose to improve the pedestrian environment and implement traffic calming measures by providing street trees, a brick herringbone pattern on the sidewalks, parallel on-street parking spaces to separate pedestrian and vehicular traffic, and heavily landscaped medians. The majority of the landscape materials will have low maintenance requirements following establishment so that the majority of the long-term maintenance resources can be directed towards maintaining the annual planting beds at the intersections.

Hardscape improvements, such as specialty paving patterns, create an enlivened streetscape

Eliminate small turf areas, which can be difficult to maintain

Preserve open sight lines at intersections



Preserve views of the city skyline

Select trees that are urban tolerant

Create focal points with flowering annuals and perennials



Create Pedestrian Environments: Street trees, landscaped medians, mid-block cross walks, parallel on-street parking and wide sidewalks help to create an environment that pedestrians find inviting.

DESIGN SOLUTION 4: Urban Intersection and Right-of-Way

Design Approach: Monoculture

Resources for Installation: Moderate

Resources for Long-term Maintenance: Low

Goals:

- Enhance a historic neighborhood
- Improve the pedestrian experience
- Attract private reinvestment to adjacent properties

Objectives:

- Use surrounding character and building materials to make materials selections
- Choose identical plants with ornamental qualities
- Eliminate small turf areas that are difficult to mow
- Implement traffic calming measures

Vegetation:

- Large vase-shaped, deciduous street trees on outer edges to frame street
- Evergreen shrubs and spreading evergreen ground covers in sidewalk planting beds for year-round interest
- Flowering perennials in median and intersection planting beds for seasonal interest and to reduce mowing

Solution Summary:

This is the same urban intersection and right-of-way as Design Solution 3. In this scenario, the project has a more modest budget for installation and maintenance but has the same goals and similar objectives. In order to achieve a similar effect, less expensive, lower maintenance plant materials are used in large masses to create a bold visual impact. Additional long-term maintenance costs are reduced by only using flowering perennials in the accent beds.

Hardscape improvements, such as specialty paving patterns, create an enlivened streetscape

Eliminate small turf areas, which can be difficult to maintain

Preserve open sight lines at intersections



Preserve views of the city skyline

Select trees that are urban tolerant

Create focal points with flowering perennials



Lower Maintenance: Once established, street trees require annual or semi-annual maintenance and pruning; large perennial planting beds and spreading evergreen ground covers also require little maintenance once established.

DESIGN SOLUTION 5: Suburban Interchange

Design Approach: Monoculture

Resources for Installation: Moderate

Resources for Long-term Maintenance: Low

Goals:

- Attract motorists into the community
- Improve maintenance crew safety

Objectives:

- Create a gateway into the community
- Choose plants that are low maintenance following establishment
- Reduce total mowed area
- Screen unpleasant views of adjacent warehouses

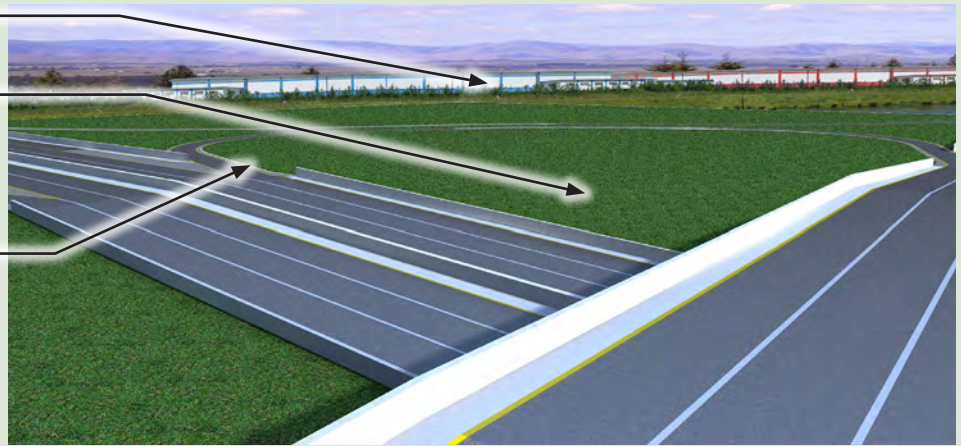
Vegetation:

- Large deciduous trees
- Small flowering trees for seasonal interest
- Turf

Solution Summary:

This example is presented to show a conventional approach to designing an interchange landscape. This suburban interchange has been identified as a primary gateway for a community. The designers decided to adopt a monoculture design approach to meet the goals and objectives of the project for budgetary reasons. This approach will minimally reduce the total amount of turf area, but the majority of the interchange will still require mowing. The deciduous tree plantings will partially screen the unwanted views of adjacent land uses, but neither completely nor year-round. This design is an aesthetic upgrade from a turf-only landscape; however, it does not completely achieve the goals and objectives of the project. Design Solution 6 presents a more effective alternative.

Screen unwanted views
Large turf areas require frequent mowing--consider reducing overall turf area
Maintain open sight lines



This approach does not completely screen undesirable views
Small flowering trees create a visual rhythm
Maintain required clear zones as turf



Plan for a Positive Effect: The landscape, as designed, does enhance the interchange; however, it does not make a strong impression.

DESIGN SOLUTION 6: Suburban Interchange

Design Approach: Naturalistic

Resources for Installation: Moderate

Resources for Long-term Maintenance: Low

Goals:

- Attract motorists into the community
- Improve maintenance crew safety

Objectives:

- Create a gateway into the community
- Choose plants that are low maintenance following establishment
- Reduce total mowed area
- Reduce stormwater run-off
- Screen unpleasant views of adjacent warehouses

Vegetation:

- Large native canopy trees (deciduous and evergreen) for year-round interest
- Small native flowering trees for seasonal interest
- Native shrubs
- Native grasses and wildflowers
- Turf

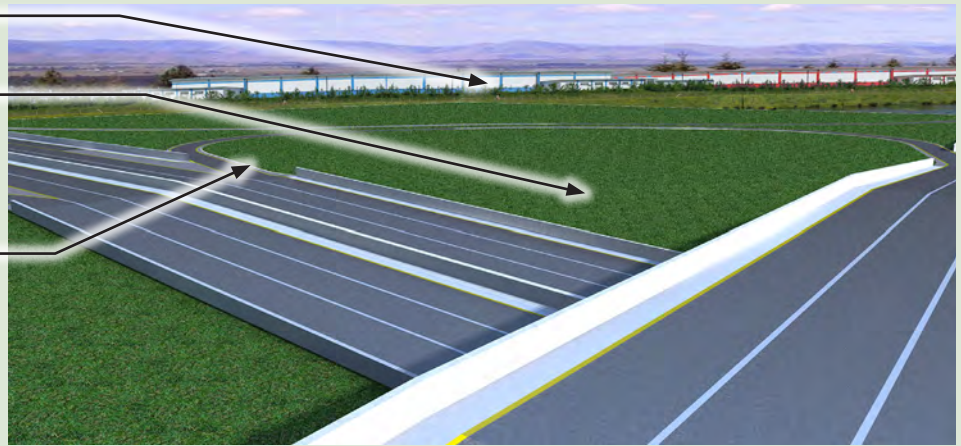
Solution Summary:

This is the same suburban interchange as Design Solution 5. In this scenario, the project has the same budget for installation and maintenance but uses a naturalistic design approach to more effectively meet the project goals and objectives. The designers chose to delineate areas inside of the ramps and at the periphery of the rights-of-way, outside of the sight triangles and clear zones, that will be allowed to return to a forest landscape environment. This can be done by either eliminating mowing while selectively removing unwanted trees over a period of years or by planting desirable native canopy trees in these areas. The designers then delineated annual mow or semi-annual mow areas. A regularly mowed edge will be maintained adjacent to the roadway. Beyond the mowed edge, native grasses and wildflowers will be allowed to grow and will be mowed annually to prevent the growth of woody plant species. Over time, these areas will develop a prairie landscape aesthetic. This aesthetic can be enhanced by tilling the soil and then using a seed drill to plant native wildflowers and grasses. This design approach may require more upfront investment, but it will reduce the long-term maintenance costs while greatly enhancing the aesthetics of the interchange and rights-of-way.



Exterior Right-of-Way Maintenance: Allow tall vegetation to grow to the edge of the clear zone. Mow annually or semi-annually to the edge of large trees to prevent the establishment of woody plant species and to achieve a naturalistic aesthetic.

- Screen unwanted views
- Large turf areas require frequent mowing--consider reducing overall turf area
- Maintain open sight lines



- Preserve existing vegetation and supplement with masses of evergreens to screen undesirable views
- Use small flowering trees at forested edge to enhance borders
- Maintain a mowed edge



Plan for a Positive Effect: This mature naturalistic landscape will make a strong impression on visitors to this community, as well as provide enjoyment for the local residents

DESIGN SOLUTION 7: Suburban Intersection and Right-of-Way

Design Approach: Ornamental

Resources for Installation: Moderate

Resources for Long-term Maintenance: Moderate

Goals:

- Enhance appearance of growing business district
- Enhance the pedestrian and motorist experience
- Increase safety for users of all modes of transportation
- Attract private investment and/or reinvestment to adjacent properties

Objectives:

- Use bold color
- Choose plants with ornamental qualities
- Eliminate small turf areas that are difficult to mow
- Create a consistent theme at business district intersections and throughout transportation corridors
- Preserve scenic vistas and views to businesses

Vegetation:

- Urban tolerant plant species
- Large, vase-shaped deciduous street trees on outside edge of roadway and columnar trees in landscape islands
- Small flowering and evergreen trees in medians for year-round interest and to create a complementary scale with street trees
- Evergreen and flowering shrubs, spreading evergreen and flowering ground covers, and flowering annuals and perennials for seasonal interest and to reduce mowing

Solution Summary:

This suburban intersection and right-of-way is located in a rapidly developing community. The designers chose to improve the pedestrian and motorist experience by providing street trees, well-defined sidewalks, crosswalks and bike lanes, and heavily landscaped medians and islands. The majority of the landscape materials will have low maintenance requirements following establishment so that the majority of the long-term maintenance resources can be directed towards maintaining the annual planting beds at the intersections.

Well-defined crosswalks and bike lanes promote safety for users of all modes of transportation

Eliminate small turf areas, which can be difficult to properly maintain

Preserve open sight lines at intersections



Preserve views of adjacent businesses and to the hills beyond

Select trees that are urban tolerant

Create focal points with flowering annuals and perennials



Multi-modal: This intersection has been designed to safely accommodate pedestrians and bicycles as well as motorists.

DESIGN SOLUTION 8: Suburban Intersection and Right-of-Way

Design Approach: Naturalistic

Resources for Installation: Moderate

Resources for Long-term Maintenance: Low

Goals:

- Enhance appearance of growing business district
- Enhance the pedestrian and motorist experience
- Increase safety for users of all modes of transportation
- Attract private investment and/or reinvestment to adjacent properties

Objectives:

- Use bold color
- Choose plants with ornamental qualities
- Eliminate small turf areas that are difficult to mow
- Create a consistent theme at business district intersections and throughout transportation corridors
- Preserve scenic vistas and views to businesses

Vegetation:

- Urban tolerant plant species
- Large native canopy trees (deciduous) on outside edge of roadway
- Small native flowering trees in medians for seasonal interest
- Native shrubs, native grasses and flowering perennials in median and perennials for seasonal interest and to reduce mowing
- Turf

Solution Summary:

This is the same suburban intersection and right-of-way featured in Design Solution 7. In this scenario, the resources for long-term maintenance are more modest and there is a higher level of desire from the community to create a unique identity with a streetscape design. The designers again chose to improve the pedestrian and motorist experience by providing street trees, well-defined sidewalks, crosswalks and bike lanes, and heavily landscaped medians and islands. However, in this case they chose to select only native and adapted species of plants. They also designed the groupings of plants to resemble the way those plants are found in nature. By doing this they will reduce the need for long-term maintenance expenditures. Also, by using plants that are native to the area they have created an aesthetic that reinforces the local community's unique identity.

Well-defined crosswalks and bike lanes promote safety for users of all modes of transportation

Eliminate small turf areas, which can be difficult to properly maintain

Preserve open sight lines at intersections



Preserve views of adjacent businesses and to the hills beyond

Select trees that are urban tolerant

Create focal points with flowering perennials and grasses



Community Identity: By using plant materials that are native to this region, the designers have helped reinforce this community's sense of identity.

DESIGN SOLUTION 9: Rural Interchange

Design Approach: Monoculture

Resources for Installation: Low

Resources for Long-term Maintenance: Low

Goals:

- Create a sense of arrival for motorists
- Improve maintenance crew safety
- Resolve erosion control issues at overpass abutments

Objectives:

- Choose plants that are low maintenance following establishment
- Reduce total mowed area
- Use vegetation with deep root systems to stabilize slope
- Preserve scenic vistas and views to businesses

Vegetation:

- Large deciduous trees
- Spreading evergreen ground cover to stabilize slope
- Flowering perennials at intersection islands for seasonal interest
- Turf

Solution Summary:

This example is presented to show how minimal investment can result in a substantial impact by improving the aesthetics of a rural interchange and right-of-way. In order to improve maintenance crew safety, the designers chose to place a spreading evergreen ground cover on the steep slopes adjacent to the overpass abutments. This will reduce the need for maintenance crews to operate mowing equipment on dangerous slopes. Flowering perennial landscape beds are located at the end of each ramp to provide a mass of color which will improve the visual interest of the interchange. Once established, the long-term costs of maintaining this interchange landscape will be minimal.

Preserve scenic vista

Steep slopes can be difficult to maintain as turf and can be dangerous for maintenance crews

Preserve open sight lines

The vertical height of the canopy trees on both sides of the overpass create a “gateway” and the trees will aid slope stabilization

Spreading evergreen ground cover reduces maintenance and will stabilize slopes

Create focal points with flowering perennials

Right Plant - Right Place: The spreading ground cover next to the overpass abutments is visually appealing but does not block the required sight lines.

DESIGN SOLUTION 10: Rural Interchange

Design Approach: Naturalistic

Resources for Installation: Low

Resources for Long-term Maintenance: Low

Goals:

- Create a sense of arrival for motorists
- Improve maintenance crew safety
- Resolve erosion control issues at overpass abutments

Objectives:

- Choose plants that are low maintenance following establishment
- Reduce total mowed area
- Use vegetation with deep root systems to stabilize slope
- Preserve scenic vistas and views to businesses

Vegetation:

- Large native canopy trees
- Small native flowering trees and native shrubs for season interest
- Native grasses and wildflowers for seasonal interest and to stabilize slope
- Turf

Solution Summary:

This is the same rural interchange as Design Solution 9. In this scenario, the project has the same budget for installation and maintenance but uses a naturalistic design approach to more effectively meet the project goals and objectives. Areas outside of the ramps and at the periphery of the rights-of-way will be allowed to return to a prairie landscape environment.

Preserve scenic vista

Steep slopes can be difficult to maintain as turf and can be dangerous for maintenance crews

Preserve open sight lines



Prairie grasses and wildflowers have very deep roots compared to turf, which will help control erosion and stabilize slopes

Create focal points with groups of small flowering trees



Prairie Power: Annual mow zones, especially those that have been enhanced by planting native wildflowers and grasses, can be stunning when large swaths of right-of-way are maintained in this manner.

DESIGN SOLUTION 11: Rural Right-of-Way

Design Approach: Naturalistic

Resources for Installation: Low

Resources for Long-term Maintenance: Low

Goals:

- Create a sense of arrival for motorists
- Improve maintenance crew safety
- Preserve the visibility of existing signage

Objectives:

- Choose plants that are low maintenance following establishment
- Reduce total mowed area
- Use vegetation with deep root systems to stabilize slope
- Preserve scenic vistas and views
- Screen undesirable view of power lines

Vegetation:

- Large native canopy trees
- Native understory trees
- Native grasses and wildflowers for seasonal interest and to stabilize slopes

Solution Summary:

This rural setting is a prominent gateway into the state of Tennessee. There is an existing welcome sign, billboard and power line. The right-of-way is currently maintained as turf. In order to reduce maintenance and improve the aesthetics of this important gateway, the designers chose a naturalistic approach to blend with the rural surroundings. The power line is screened from view by creating a massing of native trees, which are planted away from the power lines at a distance greater than their mature canopy spread. Views of the existing billboard and sign are preserved by maintaining a prairie landscape along the roadside.



Welcome to Tennessee: Using a naturalistic design approach with plants that are native to Tennessee creates a welcoming feeling and enhances the beauty of this rural setting.

DESIGN SOLUTION 12: Rural Intersection

Design Approach: Naturalistic

Resources for Installation: Low

Resources for Long-term Maintenance: Low

Goals:

- Create a unique sense of place
- Improve maintenance crew safety
- Preserve and/or enhance intersection safety

Objectives:

- Choose plants that are low maintenance following establishment
- Reduce total mowed area
- Use vegetation with deep root systems to stabilize soil
- Preserve scenic vistas and views
- Preserve sight triangles at intersection

Vegetation:

- Native grasses and wildflowers for seasonal interest and to stabilize slopes

Solution Summary:

This rural intersection is the crossroads of a major rural arterial and a minor rural collector. The right-of-way is currently maintained as turf. In order to reduce maintenance and improve the aesthetics, the designers chose a naturalistic approach to blend with the rural surroundings. The intersection islands have received a lush treatment of wildflowers while the rights-of-way will be maintained by semi-annual mowing. Noninvasive plant species have been chosen to ensure that there will not be encroachment into the adjacent agricultural fields. Views of the surrounding agricultural fields and the sight vision triangles of the intersection have been preserved by maintaining a prairie landscape along the roadside.

Preserve sight triangles at intersection

Four way stop; preserve visibility of stop signs

Existing turf shoulder and border



Prairie grasses and wildflowers will improve aesthetics

Plant species that will not obstruct signage or sight triangles at intersection



Unique Sense of Place: Using a naturalistic design approach with plants that are native to Tennessee enhances the natural beauty of this rural setting.

These sample design solutions show how the processes and guidelines provided throughout this manual can be applied. Use these examples to help guide your design and development and to provide inspiration for how you might create your own unique design solution.

CHAPTER 5

INSTALLATION AND MAINTENANCE

DEVELOP A MAINTENANCE PLAN

No landscape will be truly successful without an accompanying, achievable maintenance plan. This should be done in unison with the landscape design development. As the project is being developed, available maintenance resources should be evaluated for immediate and long-term care. Having a clear understanding of anticipated maintenance on the front end of a project will reduce any unexpected issues that may come up later. During design development, answer the following questions:

- What are the available staff, equipment and funding resources for maintenance?
- What level of maintenance will be required to maintain the landscape to meet safety requirements (clear zone, sight lines, etc.)?
- What level of maintenance will be required to maintain the landscape to achieve the intended function and project goals?

The maintenance plan is a powerful tool for TDOT and the maintenance crews and municipalities who maintain the highway. When a contract crew or municipality enters into a maintenance agreement with TDOT there should be a maintenance plan with clear objectives. By developing guidelines for an expected level of maintenance and maintenance procedures, the parties involved will have a better understanding of their roles and the maintenance goals. This will lead to a landscape that achieves the goals for which it was designed, better long-term health and appearance, and reduced maintenance costs.

The details of a maintenance plan will vary by project, but certain issues should be addressed: safety requirements, the intended function of the landscape, frequency of maintenance, time of year that tasks are to be completed, equipment and/or chemicals to be used and maintenance techniques to be used. The intended function of the landscape is an important item to consider because it ensures that the designer's intent is carried through. For instance, if the landscape design includes a row of shrubs that are intended to become a hedge screen, then that information needs to be included in the maintenance plan. If that intent is not known, it is possible that the shrubs will be pruned individually instead of being allowed to grow together

and pruned into a continuous hedge. Likewise, the clear zones and sight lines should be identified in the plan with information about how vegetation is to be maintained in those areas. Set clear guidelines for undesirable vegetation in the maintenance plan. This can include invasive species and weeds or vegetation that exceeds size requirements.

This chapter provides recommendations for maintaining roadside enhancement projects, including information about proposed maintenance techniques and frequency.

ESTABLISHING A LANDSCAPE

Establishing roadside landscapes is an ongoing process involving four general steps: preparation, installation, maintenance and long-term maintenance.

Preparation

Preparation techniques will vary depending on the type of roadside enhancement project. Enhancements to existing vegetated areas will require the least preparation. Those projects are generally limited to pruning and selected removal of plant material. This section focuses on new landscape installations. New landscape installations will require the most preparation and are necessary to provide conditions for a wide range of species. Prior to installing a roadside landscape project the plant material must be selected from a nursery, and the site must be prepared for the planting. Planting areas should be staked and, in most cases, cleared of all existing grass and weeds. Soil amendments and slope stabilization, if necessary, will also be made at this time. It is important to identify soil types and drainage patterns because soil and water are the most important factors in the growth and long-term survival of vegetation.

Selecting Plant Material

When selecting plant material from a nursery, look for healthy plants free of disease, pests, and dead vegetation or branches. The tree should have a single canopy leader, a well-tapered trunk, well-spaced branches and a healthy root structure—avoid plant material with girdling or circling roots. There should be no trunk damage (e.g., gouges, scrapes, scars) or branch wounds (e.g., broken or frayed ends). Shrubs and ground covers should appear full and have a healthy root system with no binding or circling. The plant material should be nursery-grown and chosen to conform to the requirements in the *American Standard for Nursery Stock* (ANSI Z60.1-Latest Edition), which is an excellent resource for assisting in plant selection.



Nursery grown trees at Little Creek Nursery in McMinnville, Tennessee

If the landscape plan requires massing or rows of like plants, matched plant material should be chosen to ensure uniformity. The size of the plant material will depend on its intended function, but a 2-inch caliper or less is recommended when selecting trees. Smaller trees recover more quickly from the shock of transplanting. Shrubs and ground covers, which are container grown, should be large enough to establish themselves in the roadside environment.

When plant material is brought to the project site it must be installed in a timely manner, preferably the same day. Plants should be healed-in on site in a staging area and kept watered throughout the installation process. Ideally, the site should be fully prepared for the plantings prior to their delivery. On large projects, multiple deliveries should be coordinated as the site is prepared.

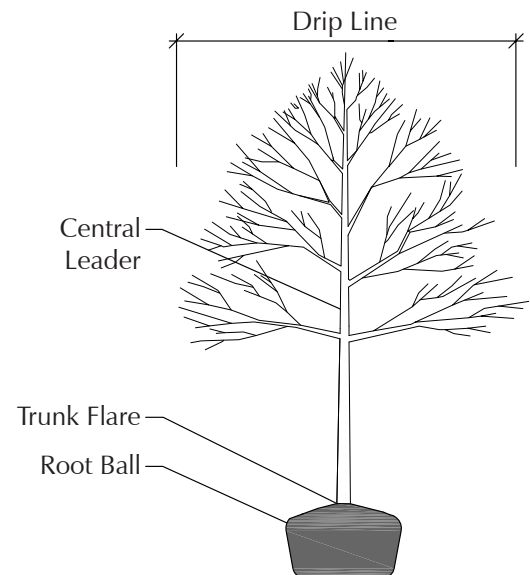
Soil Amendments

Compacted soils, rocks and debris are common in the roadside environment as a result of roadway construction. The qualities of soil that promote and sustain plant growth are good water filtration and retention, adequate aeration and low compaction/density.

A soil test should be completed for the project site to determine soil composition and to identify necessary soil amendments that will improve growing conditions. On long stretches of roadside enhancement projects, soil samples should be taken from both sides of the roadway at one-mile intervals. In smaller roadside enhancement projects, a minimum of four soil samples should be taken. These tests can be completed by Agriculture Extension Offices and other qualified professionals.

After the planting area has been cleared of vegetation and tilled, soil amendments can be made to improve growing conditions. Soil amendments reduce the need for water and provide viable nutrients for plant uptake. Soil amendments include compost and compost teas, lime, sulfur or fertilizer application (nitrogen, phosphorous, potassium). Generally, new plants do not need fertilizer if there is adequate organic material, but fertilizers may be added if the soil is not naturally producing the nutrients that plants need. Excess nitrates and phosphorous can run off into streams, affecting the streams' ecology.

Figure 5.1: Tree Diagram



Adding organic material, such as compost, to the top 1-½ inches of the planting area has been used successfully in other roadside projects. Organic material helps soil retain water and nutrients, improves soil structure and encourages root growth. The premise behind compost and organics is making minerals and nutrients available to plants. Compost and compost teas work naturally by reintroducing beneficial organisms that unlock the nutrients existing in the soil and making them available to the plants. No excess nutrients or phosphates are carried into streams or groundwater.

The soil pH can be adjusted with lime (to decrease acidity), ammonium sulfate (to increase acidity) and sulfur (to increase acidity). These should be applied with caution, as improper applications can result in plant damage from chemical burns.

Slope

Some sites will require slope or soil stabilization after the removal of existing vegetation. Drainage patterns may also cause erosion. Soil amendments can improve slope conditions because healthy soils support healthy root systems, which stabilize slopes and reduce erosion potential. Compost, especially, is effective for temporary erosion prevention and sediment control during construction and for permanent erosion prevention and sediment control by establishing sustainable vegetation. TDOT's *Special Provision Regarding Compost (SP801C)* provides guidelines and requirements for using compost in the landscape.



Installation of an erosion control blanket

Immediate solutions to erosion and slope stabilization are needed on new construction projects to minimize sediment loads in runoff. Sod and turfgrass are typically used on new construction projects, but alternatives to turfgrass can reduce the long-term need for mowing and improve aesthetics. These include hydro-seeding native grass and forb mixtures in combination with polymer soil stabilizers and temporary erosion control blankets. Native grasses are not ideal for all erosion prevention situations. Because most native grasses are bunch grasses, they do not have the soil-stabilizing abilities of turfgrass; however, native grass seeds can be included in mixes with turfgrass such as fescue or Bermuda.

Erosion control blankets are also used for slope stabilization but have weed control benefits as well. These blankets are designed to promote plant growth by allowing water and light to penetrate the soil. Holes can be cut in the fabric to allow for planting trees, shrubs and ground covers. The

blankets are made of natural and synthetic fibers. Consult TDOT's *Statewide Stormwater Management Plan* and the TDOT Design Division *Drainage Manual* for information about erosion prevention techniques and guidelines to meet state requirements for land disturbance permits.

Planting

The second stage of establishing a landscape is installation. Implementing proper installation techniques will increase survival rates of the plant material. Planting requires the placement and spacing of a plant to ensure healthy root systems. Plants must be put in the ground in a proper sized planting pit, backfilled with the proper soil and secured, if necessary.

The following guidelines and details provide information for the proper installation of various plant materials.

Flower Installation

1. Till the planting area to loosen the soil to a depth of 6 to 8 inches. Remove any rocks over 1-inch diameter, roots and large debris.
2. In areas with poor soils, add a 1-½ inch layer of organic material, such as compost.
3. Create a uniform planting surface level with the adjacent ground.
4. For flowers in containers or flats, remove the plant material and loosen the roots. Make a hole large enough to accommodate the roots, place the plant into the hole and gently tamp the soil to stabilize the plant and remove air pockets. For bulbs the process is similar, but the depth of the planting hole will vary by plant species. A plant spacing guide for is shown in Detail 5.1.
5. Thoroughly water the planting area after all plants have been placed.
6. After watering, add 3 inches of mulch. Keep the mulch away from the base of the plant material.

Shrub, Ornamental Grass and Ground Cover Installation

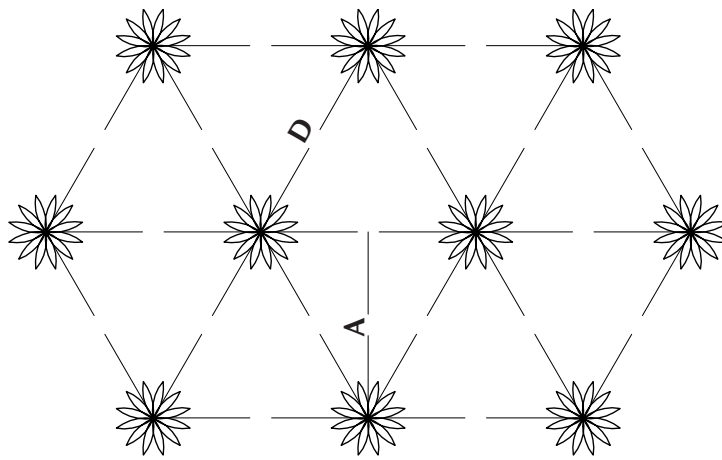
1. Till the soil around the planting area to create a pit that is three times the width of the root ball and no deeper than the depth of the root ball. Remove any rocks over 1-inch diameter, roots and large debris.
2. Remove the plant from the container at the time of planting and no sooner. Check to ensure the plant is firmly intact and is not root-bound.
3. Center the plant in the planting pit, and straighten it to be level with the ground surface.

4. If the plant is wrapped with burlap and wires, remove them from the tops and side. If the plant is bare root, spread the roots carefully, and work the soil into them. Remove any broken roots.
5. After the plant is centered in the pit, loosen the soil and carefully tamp around the base of the root ball to eliminate air pockets.
6. Backfill the planting pit with the excavated soil. Remove any rocks or large debris. If necessary, add imported topsoil and other organic material to the planting pit.
7. After the pit has been backfilled halfway, add water slowly. Finish filling the planting pit and water again to soak the new planting. Additional watering techniques are discussed later in this chapter.
8. After watering, add 3 inches of mulch. Keep the mulch 6 inches away from the base of the plant material.

See Details 5.1 through 5.3 for shrub and ground cover planting details.

Detail 5.1: Plant Spacing Chart

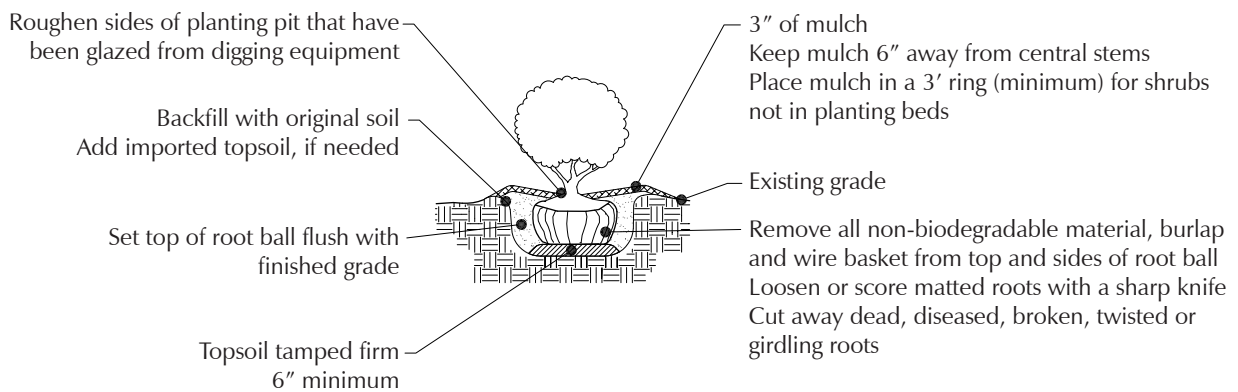
To determine the number of plants needed in a given area, multiply the planting area (in square feet) by the number in the chart under "Number of Plants per Square Feet." For example, if the planting area is 200 square feet and the desired spacing is 6" on center (O.C.), multiply 200 by 4.61. You would need 922 plants to fill the area (200 x 4.61 = 922).



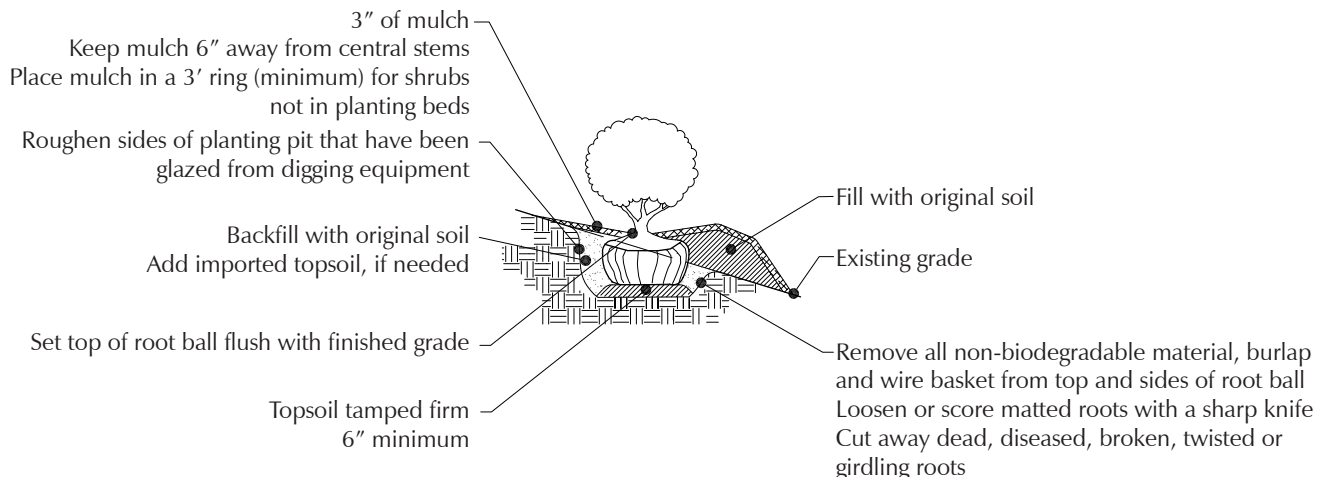
Spacing of "D"	Row Width of "A"	Number of Plants per Square Feet
6" O.C.	5"	4.61
8" O.C.	7"	2.60
10" O.C.	9"	1.66
12" O.C.	10"	1.15
15" O.C.	13"	0.738
18" O.C.	16"	0.512
24" O.C.	21"	0.290
36" O.C.	31"	0.128
4' O.C.	42"	0.073
5' O.C.	52"	0.046

O.C. - on center

Detail 5.2: Shrub and Ground Cover Planting



Detail 5.3: Shrub and Ground Cover Planting on Slopes



Tree Installation

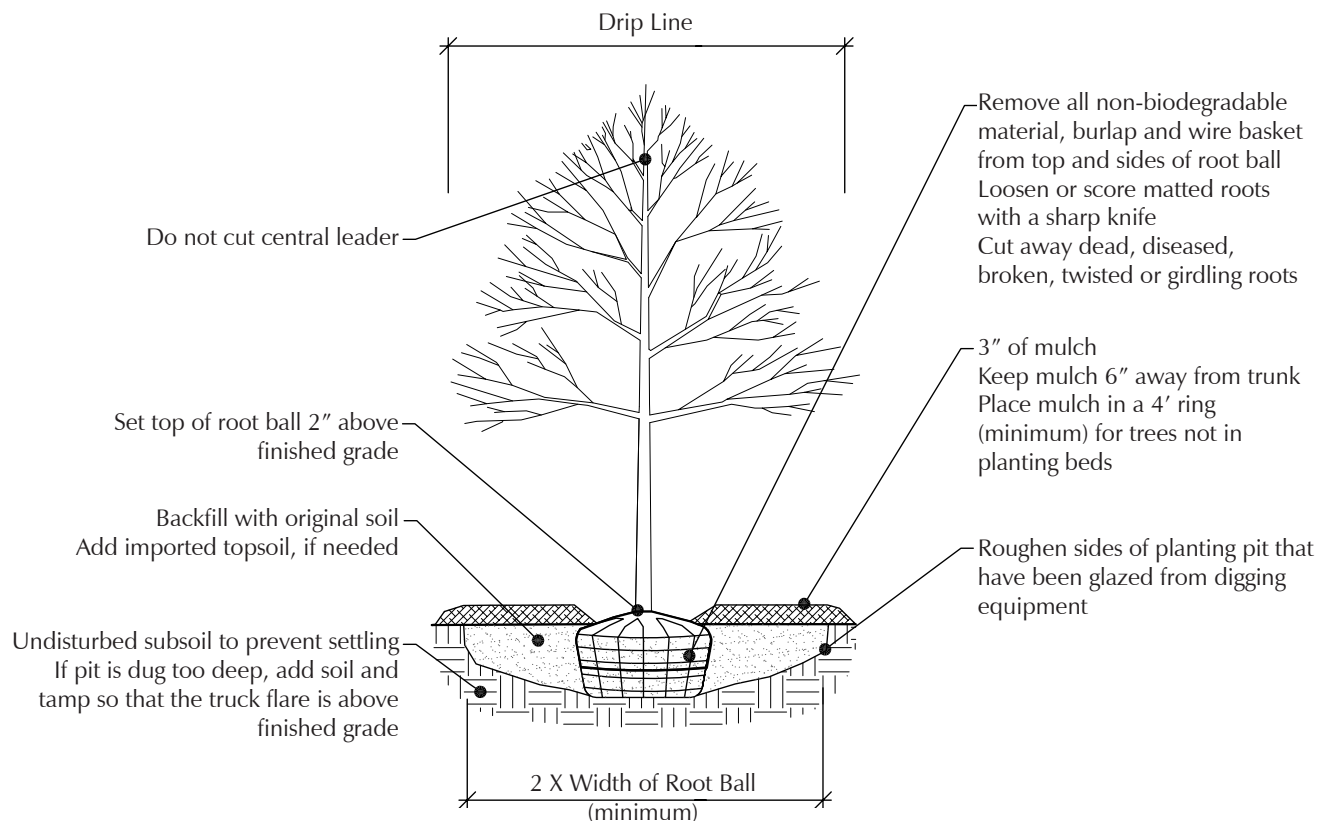
The following tree planting guidelines were developed by the Tennessee Department of Agriculture, Forestry Division (<http://www.state.tn.us/agriculture/forestry/>).

1. Trees should be planted in late fall to early spring (November to March).
2. The planting pit should be at least twice the width of the root ball or container to encourage the roots to grow into the soil. The sides of the planting pit should be sloped, and the pit should be not deeper than the root ball or container to prevent the tree from settling or being placed too deeply.
3. For a container tree, remove the container. For a balled and burlapped (B&B) tree, remove the rope around the trunk and loosen the burlap. If the root flare is not visible, gently remove soil from the top of the ball until the tree is again at proper soil level. Check for large circling roots. If present, use shears to make a clean cut. Girdling roots will continue to grow in a circle, resulting in the death of the tree. If the circling roots are fibrous, make three or four vertical slits into the sides of the root ball about 1 inch deep. On balled and burlapped trees, remove as much wire, burlap and other materials from the top and sides of the root ball once the tree is in the planting pit. Remove all labels, tags, wires and rope from the trunk and branches to prevent girdling as it grows. Always move the tree by the container or root ball. Do not move trees by grabbing the trunk.
4. To backfill the planting pit, use the excavated soil. If the soil is very poor and appears to need topsoil, increase the pit size and sparingly mix in some local topsoil. Remove stones and other debris. Fill the planting pit halfway with backfill, then water. Finish filling the planting pit with the backfill and water again. Make sure to work the soil around the root ball firmly to eliminate any air pockets. Make sure the tree is vertical and properly supported, but do not pack the soil around the trunk. The trunk flare should be visible when the backfilling is complete.
5. The area around the tree should be mulched with wood chips, bark chips or pine mulch. The mulch should be 3 inches deep and cover the entire planting area and beyond. The mulch needs to be placed in a ring around the trunk of the tree, but it must be kept away from the trunk of the tree to keep insects away and prevent the trunk from being excessively wet. Mulch helps conserve soil moisture, reduces the competition from unwanted weeds, keeps lawn mowers and string trimmers from

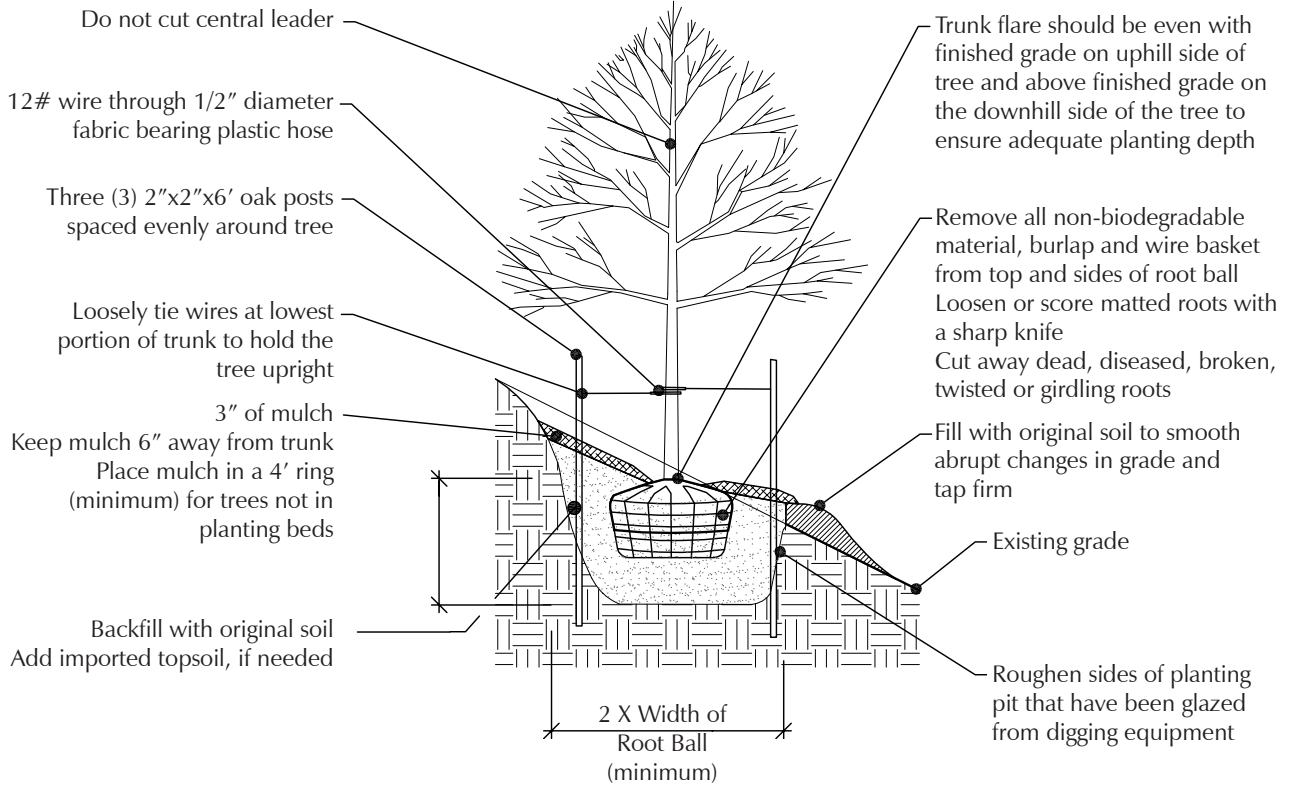
- damaging the trunk, and moderates soil temperature extremes. Do not make mulch volcanoes.
6. After the tree is in place, prune only the branches that are dead, broken or severely deformed. Buds produce hormones that stimulate root growth, so keep the removal of buds to a minimum. Additional pruning techniques are discussed later in this chapter.
 7. Staking is not necessary if the tree has a proper size root ball and has not been pruned too high. If staking is needed for support (e.g., plantings on slopes), attach them so the tree has some sway. Remove the wires or straps from the tree after one growing season.
 8. Generally new trees do not need fertilizers. Fertilize the first year only if a specific problem develops.

See Details 5.4 through 5.8 for tree planting details.

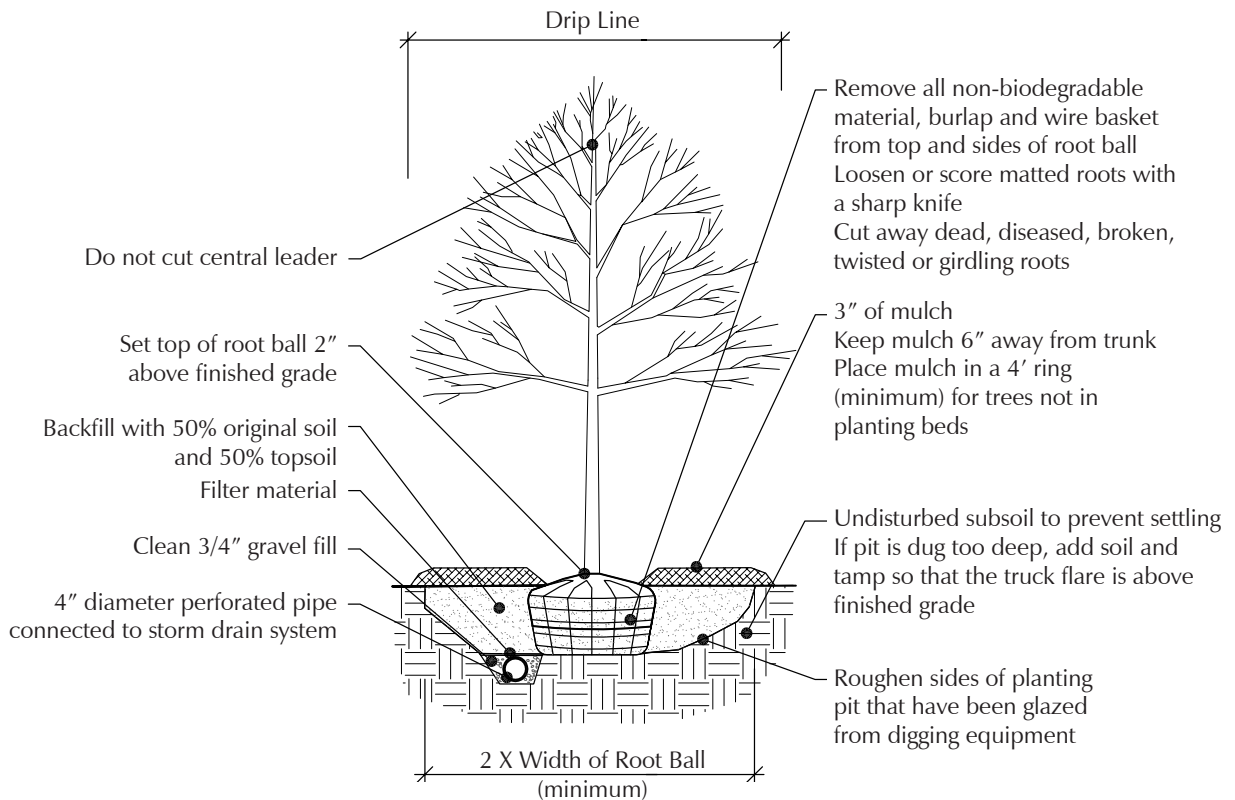
Detail 5.4: Deciduous Tree Planting



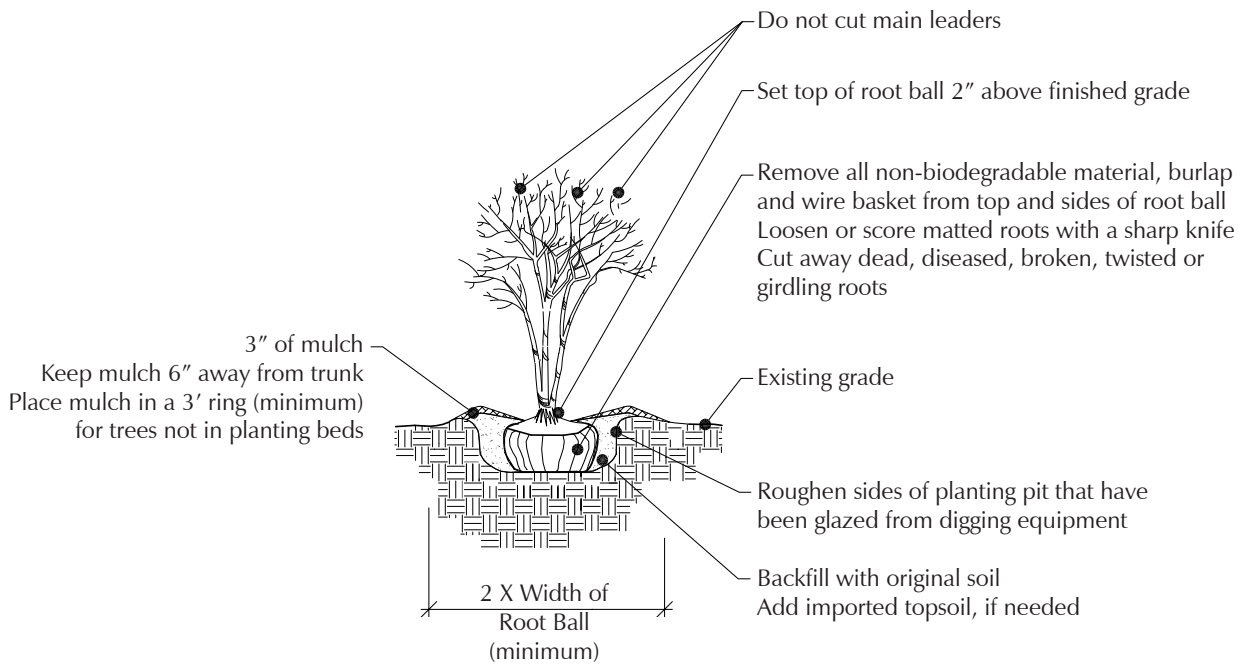
Detail 5.5: Deciduous Tree Planting on Slopes



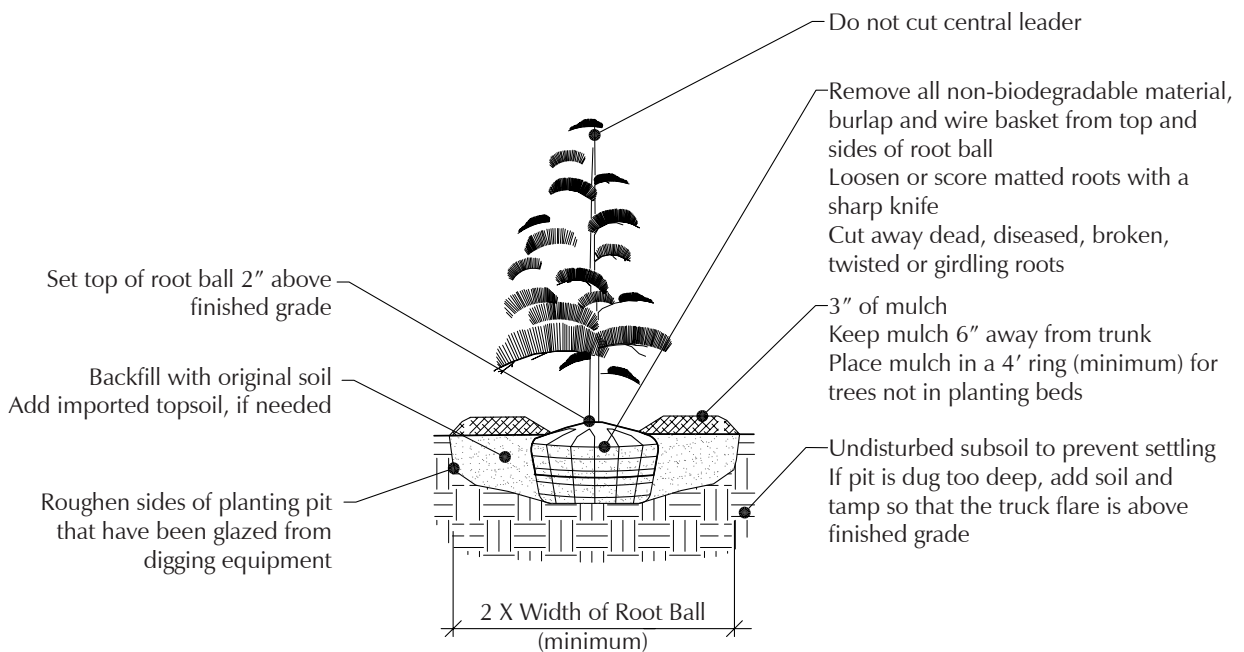
Detail 5.6: Tree Planting for Poorly Drained Soils and/or Urban Areas



Detail 5.7: Multi-Trunk Tree Planting



Detail 5.8: Conifer Tree Planting





Tree grates (top and middle) and pavers (bottom) are often used for street tree plantings

Street Tree Installation

Street trees must be able to tolerate confined growing spaces and environmental pollutants and have few insect and disease problems. Trees that are good candidates for street tree applications are listed in the Appendix as “Urban Tolerant.” Ordinances regulating street tree placement will vary depending on the municipality, but the following list provides some basic guidelines for determining appropriate placement of street trees.

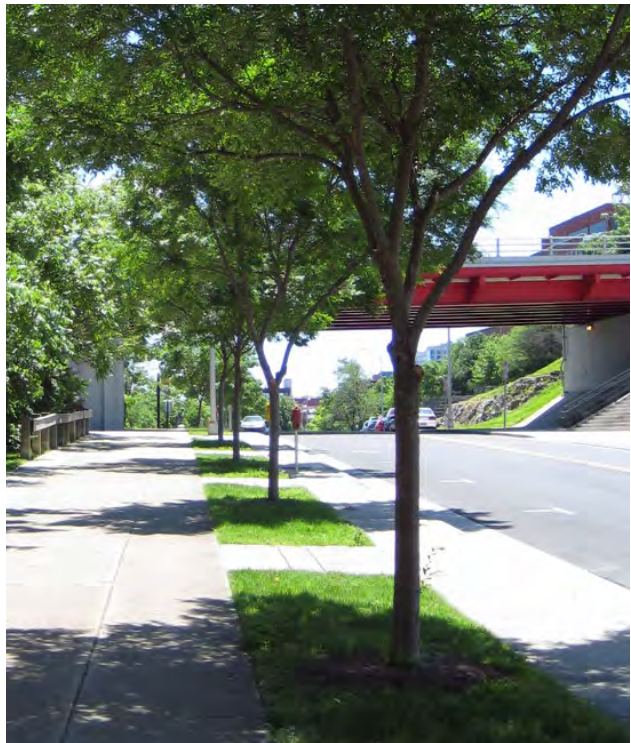
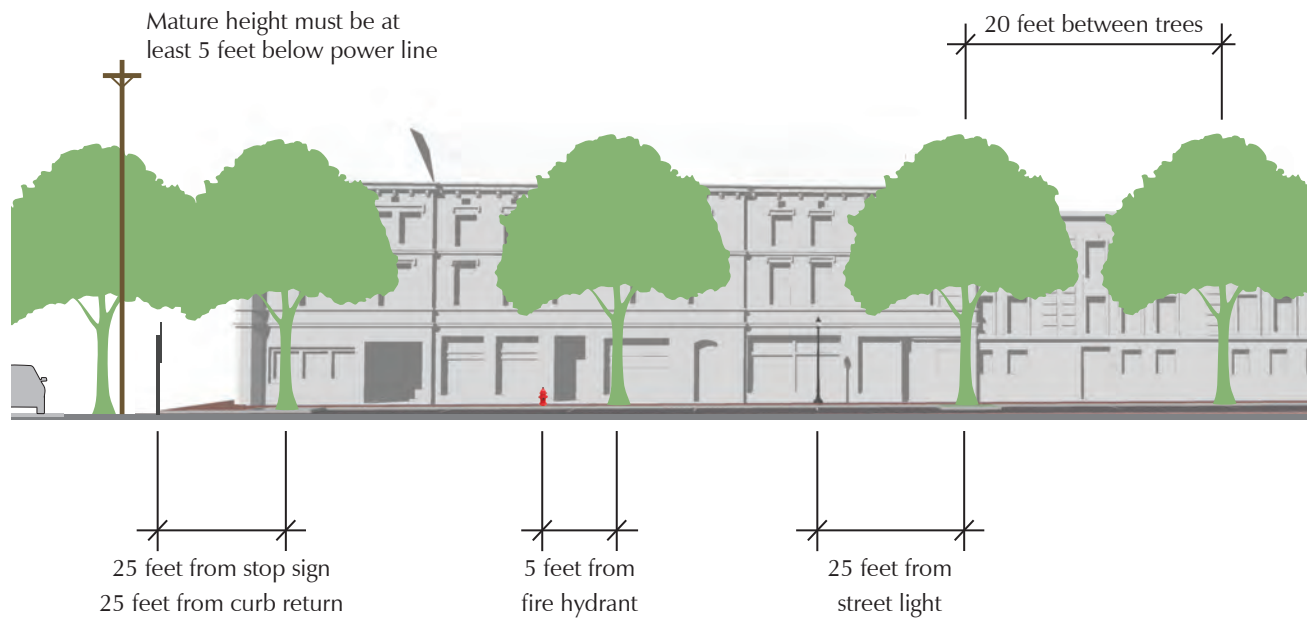
Trees should be planted no closer than:

- 25 feet from the curb return of an intersection
- 5 feet from alley margins and driveways
- 5 feet from fire hydrants, underground utilities, and utility poles
- 10 feet from directional traffic signs
- 2 feet from property lines
- 25 feet from stop or yield signs
- 25 feet from street lights; if a narrower-growing species of tree is selected, 15 feet may be appropriate
- 20 feet or more from adjacent trees; consider the size of a mature canopy for a given species of tree when determining the spacing of street trees

Soil conditions present the most challenging factor for street trees. Tree wells are often too small to provide adequate soil volume and the soil structure is often compacted, filled with debris and does not have the proper pH to sustain the tree. While a tree may still grow and survive in these poor conditions, it will never reach its species’ size potential. The key to improving a street trees performance is to maximize the soil rooting volume. This can be achieved by providing larger sidewalk cutouts for tree wells or large, continuous tree planting strips.

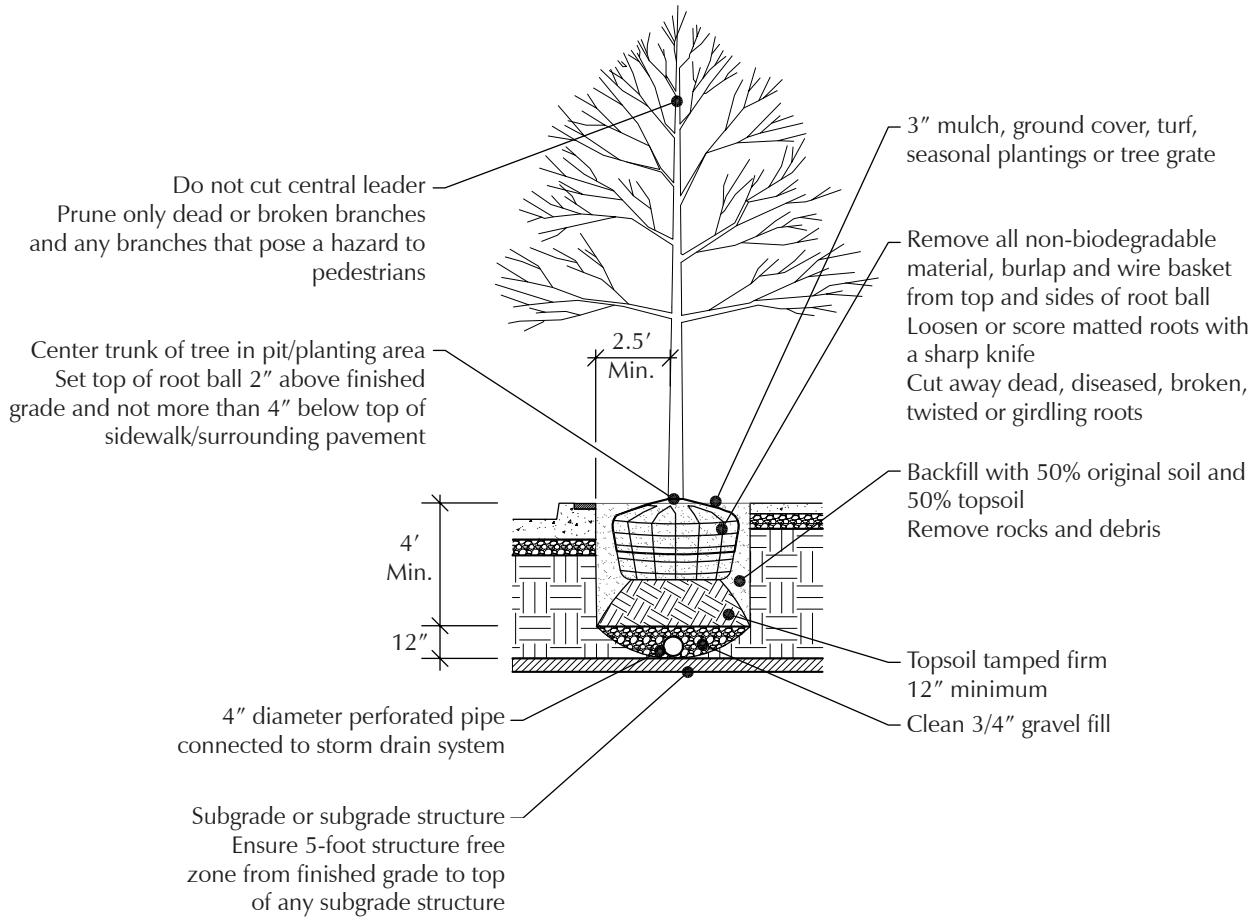
See Detail 5.9 for a street tree planting detail.

Figure 5.2: Minimum Spacing Recommendations for Street Trees



Large, continuous planting strips, grass (left) or landscaped (right), are ideal for street trees

Detail 5.9: Street Tree Planting



Wildflower and Native Grass (Seed) Installation

Successful wildflower and native grass plantings are a result of choosing the correct seed mixes and proper plant bed preparation. On Tennessee roadsides, native grasses and wildflowers must adapt to harsh conditions and poor soils. The following guidelines should be used for wildflower and native grass seed.

The time of year for seed installation will vary depending on the species. Most are planted in the spring, but a fall planting allows for early germination and growth. In urban environments, it is more effective to use potted wildflowers and native grasses for faster establishment.

The soil preparation for seed installation is different than for the plant materials already discussed, but a soil test should still be conducted. Amend the soil as necessary for compatibility with the needs of the species being used. Planting beds can be prepared in two different ways, but the most important thing is for the area to be as weed-free

as possible. The first option is to remove all the existing vegetation from the planting area and till the soil to a depth of only 1 inch. If the soil is disturbed any deeper than this, dormant weed seeds will be disturbed and brought back to the surface where they will grow. After the soil has been tilled, an herbicide like Round-Up® should be applied to kill any remaining existing vegetation. This should be done three days in advance of the installation of the seed. Once the soil is ready, broadcast the seeds over the area and rake or drag the planting area to ensure seed contact with the soil.

The second option is to plant over existing turf cover. For areas with a thin turf cover, seeds can be broadcast over the area and raked to ensure seed contact with the soil. For areas with thicker turf cover, the turf should be scalped to 1 inch. After the clippings are removed, the seed should be broadcast and raked or dragged into place, and the clippings can then be reapplied to the area as mulch. If a mechanized seed drill is used, the clippings can stay in place after the turf has been scalped.

In order for the seeds to become established, the area should be watered at the time of planting. The planting area will also need adequate moisture during the time leading up to germination. This can be done by rainfall or by supplemental watering techniques discussed later in this chapter. The planting area will become drought tolerant once the seeds have established.

The TDOT Maintenance Division's *Herbicide Recommendations Manual* includes directions for the pre-plant treatment of wildflower beds for weed control. This treatment is conducted in the fall, prior to the wildflower planting.

Mulch

Mulch conserves soil moisture, moderates soil temperature, reduces erosion and reduces weeds; however, applying mulch too thickly can prevent water infiltration. Mulch should be placed around all vegetation immediately after planting, as described in the planting installation instructions and details. The actual placement of the mulch will depend on the layout of the planting area. For individual plants, the mulch placement is shown on the details in Details 5.2 through 5.8. In smaller planting beds, the entire area should be mulched. This will help reduce maintenance within the planting bed and will protect the vegetation from mowing equipment.

There are many types of mulch available. Each provides a different aesthetic, advantages and disadvantages. The replacement schedule will vary depending on the mulch type, but it should be replaced regularly to maintain a 3-inch depth.

Bark (Hardwood)

Shredded hardwood bark is one of the most popular mulches used in landscape plantings. It is a byproduct of the paper and lumber industries that can be recycled as mulch. Its pH is slightly alkaline, but this problem can be managed by adding 3 pounds of elemental sulfur per cubic yard of bulk bark or per 100 square feet of bed area.

Bark (Softwood)

Chunk pine, fir and redwood barks are the most popular types. This material is acidic in its reaction and does not require any additives to modify the pH. Softwood barks are more resistant to decay than hardwood bark. They are available in a variety of sizes that fit many landscape needs.

Pine Needles

This material makes a light, airy and attractive mulch. It is recommended to leave pine needles beneath pine trees rather than remove them. Pine needles will make the soil acidic and is good to use around acid-loving plants.

Compost

Compost is one of the best mulch materials and should be used as much as possible in roadside projects. Not only is compost beneficial to the plants, it also has environmental benefits as a recycled product.

Wood Chips

This material is available from garden centers, arborists, power companies and municipal yard waste facilities. It is very durable material. In landscape beds, nitrogen deficiencies will develop if fertilizer is not periodically applied.

Maintenance

After the landscape has been installed, ongoing maintenance including watering, mowing, pruning and weed control will be required. It is necessary to integrate maintenance practices as part of the design to achieve the intended function and project goals.

Watering

Water is essential for plant survival. Newly planted material must have a regular source of water to establish healthy root systems that will provide the plant with essential nutrients and structural support. When rainfall does not provide adequate moisture, supplemental watering is required. With the exception of some ornamental plantings in particularly harsh environments, roadside enhancement projects will not require watering after they become established.

During establishment, a slow, thorough watering is recommended to keep adequate moisture in the soil and penetrate beyond the root zone. There are three watering options: water truck, refillable water bags and irrigation. Watering from a truck should be done with care so that the force from the water does not damage plants or disrupt the mulch layer. Watering at heavy rates will result in runoff and inadequate infiltration.

On many rights-of-way plantings, trees can be watered using refillable tree watering bags. These products provide trees with a constant, slow supply of water. Depending on the bag size, tree species, soil and weather conditions, they may only require filling once a week. The bags must be removed after the tree has become established.

Irrigation is the least intensive watering practice but requires upfront installation costs. Irrigation systems are most feasible in urban, community and some suburban environments and are worth the added cost to ensure survivability.

Establishment Period

A watering schedule is a necessary detail of the maintenance plan to ensure that plants are not being under- or over-watered. Even plants that tolerate dry conditions must be watered regularly through their establishment period. The establishment period varies depending on the type of plant, area of the state and specific site conditions. Generally, the establishment period for trees is at least one year for every 1-inch caliper (TCIA). Shrubs and ground covers require six months to a year to establish; flowers establish much more quickly and seeds require adequate moisture up through germination.



Refillable watering bags

Watering Rates

The Tree Care Industry Association (TCIA) describes standard practices for watering trees. Small-caliper trees need less water and establish faster than those of a larger caliper. It is recommended that newly planted trees receive 10 gallons of water per week for every 1-inch caliper. To ensure infiltration, trees should be watered slowly and thoroughly to penetrate beyond the root zone. Never dig trenches that create bowls to hold water around a tree trunk. This technique will not encourage roots to spread away from the root ball. The top 4 inches of soil in the tree's drip line should be kept moist between watering.

Shrubs, ground covers and ornamental grasses should be watered 2 to 3 times per week for 8 weeks after installation, and then once a week until they are established.

Mowing

Mowing patterns, techniques and timing have dramatic effects on the quality of the roadside environment. Mowing must be integrated into the design, and the areas to be mowed should be clearly defined as part of the maintenance plan.

Roadway rights-of-way are currently mowed by TDOT staff, contract crews and/or local governments. Mowing frequency depends on the region and time of year, but is typically three or four times a year along rural state routes and interstates, six times a year on urban interstates and as often as once a week within urban centers.

Mowing is currently performed as outlined in TDOT's *Special Provision Regarding Right-of-Way Mowing (SP806)*, but this manual makes recommendations for introducing new mowing practices. This section will outline the concept of reduced mowing and will introduce ideas for new mowing patterns that will not only save staff, fuel and equipment costs, but will provide numerous environmental and aesthetic benefits.

Reduced Mowing

Reduced mowing is the practice of reducing both the frequency and area of mowing in the right-of-way. The goals of reduced mowing are to facilitate safe, environmentally and economically beneficial, and manageable roadside landscapes. The direct benefits of this practice are:

- Fewer staff hours
- Lower fuel usage and costs
- Less equipment maintenance
- Reduced fuel emissions to improve air quality
- Improved, self-sustaining plant communities

While this practice may not be acceptable in some urban environments that require a higher level of maintenance, there are thousands of miles of roadways throughout Tennessee where this practice is not only acceptable but will enhance the natural beauty of our state. Aesthetics and public perception of reduced mowing have been a concern, but results from a statewide survey show that the public prefers a ‘naturalized’ roadside, but with a mown edge. These results match other studies that show a preference for natural landscapes but with some sign of human intervention (Kaplan).

Reduced mowing can be achieved through many methods, but the general technique is the same. The first step is to define the areas along the roadside into three distinct zones: regular maintenance zone (Zone 1), annually mowed zone (Zone 2), no mow zone (Zone 3). These are the broad definitions of the zones, but actual mowing practice will vary depending on the landscape classification (urban, suburban or rural), width of the right-of-way, adjacent land uses, required sight distances, land form and unique site conditions.

Zone 1, or the regular maintenance zone, requires regular mowing along the edge of the traveled way and around signs and structures. This zone is maintained by mechanical equipment to prevent trash accumulation and to provide visibility to structures and potential obstacles. Zone 1 is mowed three times a year with one pass of a mower blade, not to exceed 15 feet, at the back edge of the shoulder and around structures and signs. If there is a drainage ditch (grass or concrete swale) adjacent to the roadway, this zone will extend to the back edge of the ditch.

Figure 5.3: Reduced Mowing in the Right-of-Way

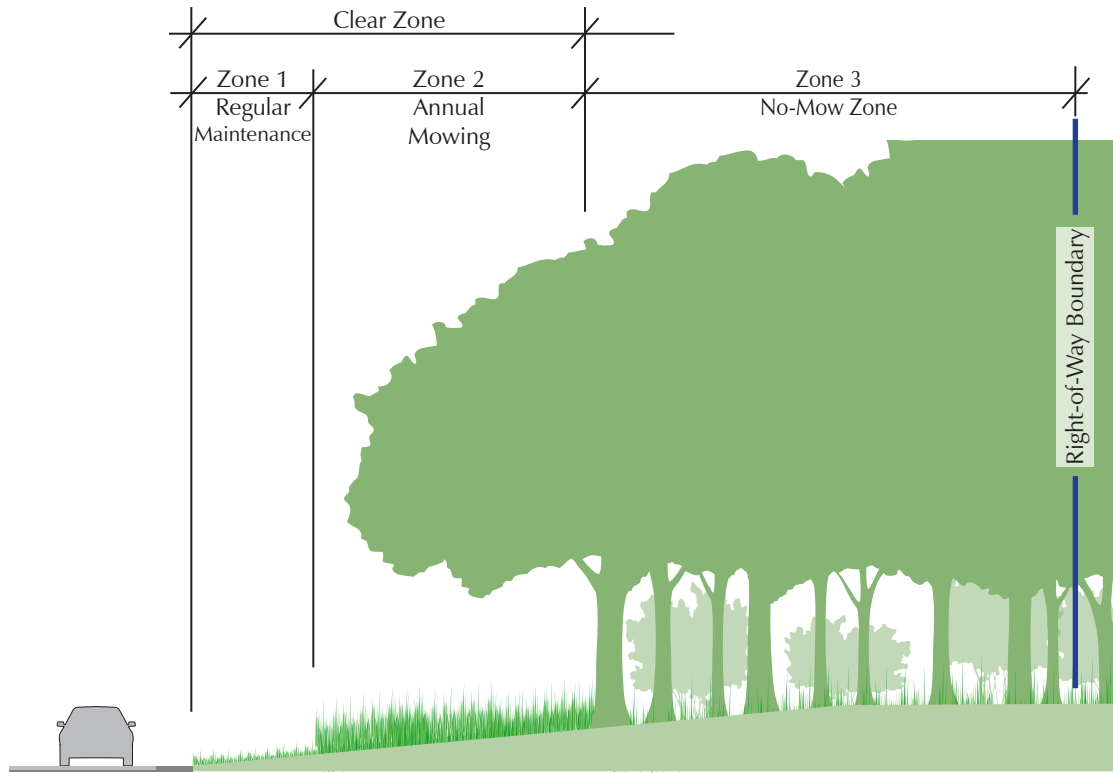


Figure 5.4: Reduced Mowing in the Right-of-Way with Drainage Ditch

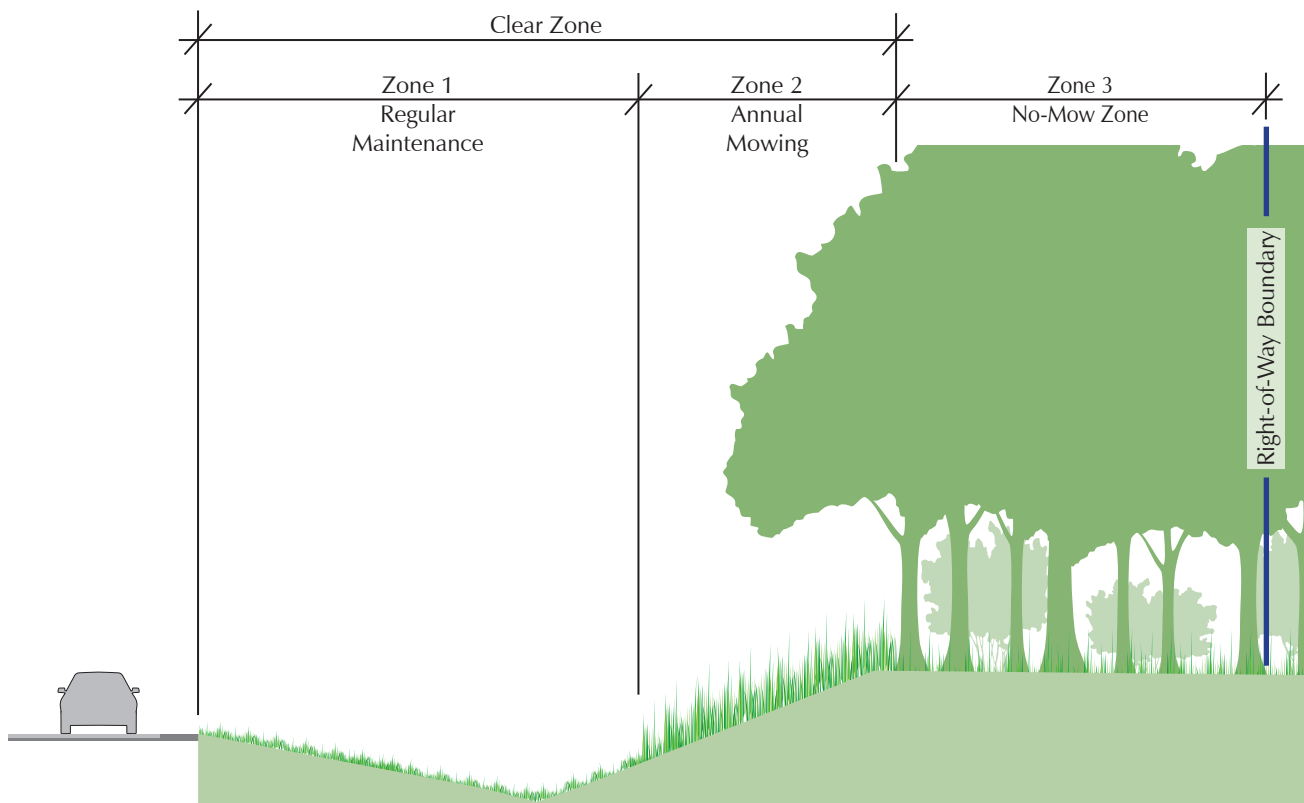
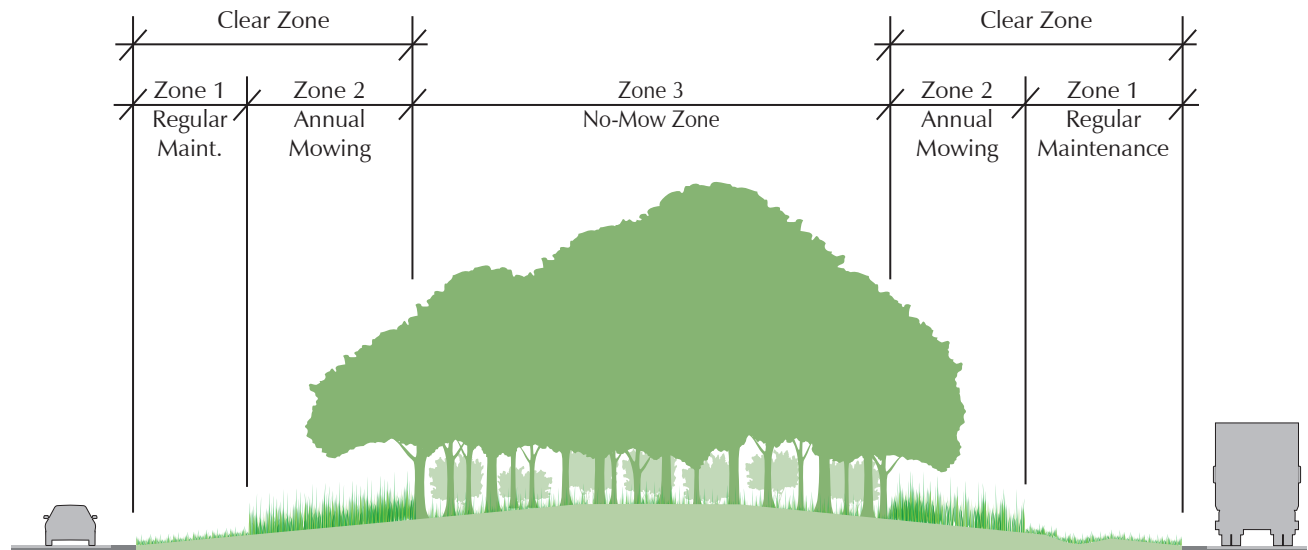


Figure 5.5: Reduced Mowing in Medians



Zone 2 receives annual mowing to the desirable clear zone. Mowing this transition zone only once a year will prevent woody vegetation from growing to a size that is a safety hazard. Annual mowing should take place in late spring when plants are weakened after expending their energy to produce leaves. Over time, less woody vegetation will appear and this zone can be mowed less frequently.

In areas where the right-of-way is narrow, reduced mowing may be confined to Zones 1 and 2, but where the right-of-way is wider there is a third zone. Zone 3 is the no-mow zone that is allowed to naturalize and reforest. This zone extends to the right-of-way, but it can also be the area in the center of wide medians or interchanges.

As a short-term solution, simply mowing less frequently and less area will achieve the desired environmental and economic benefits. Long-term solutions must be implemented in some Zone 3 areas to maximize environmental and economic benefits and prevent future maintenance issues. After the first two to three years of no mowing, this Zone 3 will begin to reforest with woody vegetation; however, it can become dominated by invasive or undesirable plant species if left completely unattended. Intervention in the first few years of natural succession will lead to a healthier, self-sustaining plant community with fewer long-term maintenance issues. After three to five years, a canopy will begin to establish, and less intervention will be required.

The growth of desired species can be promoted in two ways:

1. Removing undesirable vegetation mechanically or controlling the growth of undesirable vegetation through chemical applications on an annual basis. This method will require some training and education among maintenance staff to identify desirable and undesirable species.
2. Removing all vegetation and planting with desirable plant species. This will require some annual maintenance in the first few years of establishment, but will quickly become self-sustaining.

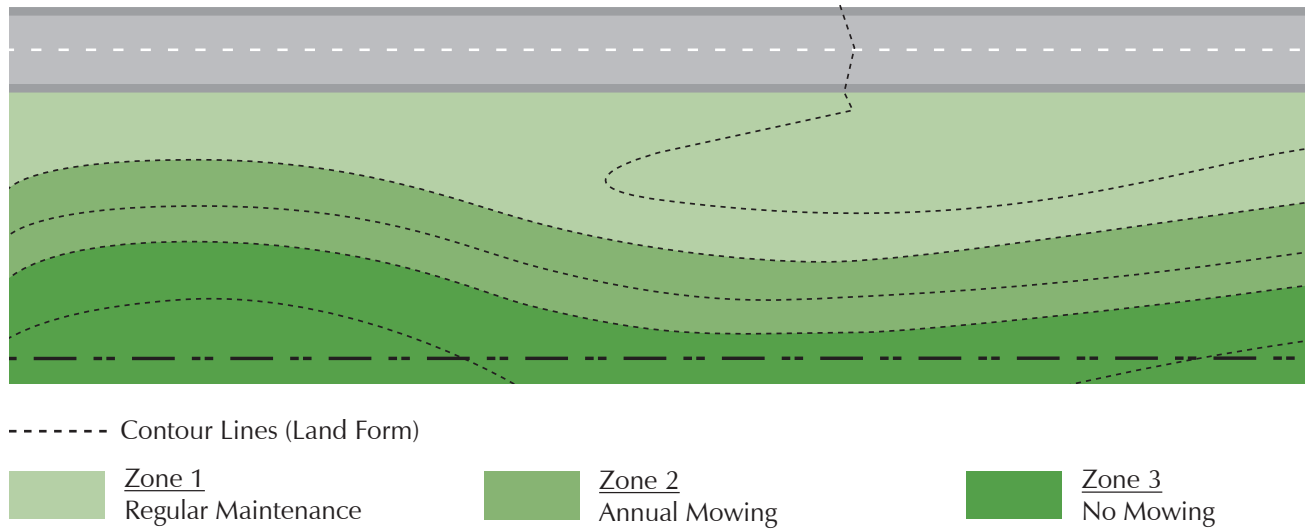
Spot-treating undesirable vegetation through mechanical or chemical control is recommended in Zone 3, where promoting desirable species will increase aesthetic value. There is a short window of opportunity in the winter to use a foliar spray to control exotic and invasive plant species. At this time of year most native deciduous trees have lost their leaves, while many exotic and invasive species retain theirs. This technique is especially effective on honeysuckle and privet but should be used with caution so that desired vegetation, especially evergreens, is not destroyed. This treatment should be conducted during the winter for three to five years until the desired canopy is established.

Large, healthy trees should be promoted in the roadside landscape if their mature height is less than their distance from the road. Branches that overhang the road or are in danger of falling on structures should be removed.

Chemical Mowing

There is currently a pilot program underway in which TDOT is exploring the use of chemical mowing as a means of reducing the frequency of mowing cycles. Chemical mowing is a term used to describe the practice of applying herbicides to stunt or suppress weeds and grasses. This technique reduces mechanical mowing and controls problem weeds along shoulders, slopes, around structures and other areas. There are risks to using chemical mowing. The *Herbicide Recommendations Manual* published by the TDOT Maintenance Division provides guidelines for the use of chemicals in the right-of-way.

Figure 5.6: Mowing Patterns



Mowing Patterns

Mowing patterns should be determined by slope, topography, viewsheds, landscape areas and safety requirements. Mowing techniques and patterns have a direct influence on perceptions of roadside beauty. Mowing creates the cleanliness and evidence of human intervention that the public desires (Kaplan).

Steep slopes should only be mowed at their base, or toe. Do not mow when the soil is saturated; mowing equipment on wet soil causes ruts. The ruts are unattractive, collect water and create erosion issues on steep slopes. Mowing should be done parallel to topographic contours. Care should be taken around existing vegetation and landscape beds to prevent damage. Smooth cuts, deliberate lines and healthy vegetation are appealing to the public. Long, sweeping contour mowing enhances landscape features and creates a pleasing curvilinear edge.

Mowing patterns play an important role in determining the reduced mowing zones. Items that should be considered when determining the reduced mowing zone are: keeping roadside signs and structures cleared of vegetation, land form, existing vegetation, wet or boggy soils and adjacent land use.

Pruning Techniques

Pruning is used to achieve form, to keep vegetation healthy and for safety. Pruning occurs on small and large scales. There are appropriate techniques for both, which are guided by the size of the area, landscape classification, type of plant, intended function, safety requirements and

time of year. Some pruning can be avoided by following the “right plant, right place” methodology. For example, where visibility or pedestrian access is an issue, choose trees with higher branching structures instead of trees with low or drooping branches. Trees with a vase shaped or columnar form are ideal for these situations.

In order to keep maintenance workers safe and plant material healthy, only use equipment designed for tree trimming and pruning. During design development and plant selection, consider the accessibility to the planting area if regular pruning will be required. Projects that require unique or intense pruning techniques are better suited for areas away from the roadway, rather than narrow medians or small islands.

Along highway rights-of-way, avoid pruning by keeping trees with large canopies clear of the shoulder. Tree canopies can overlap clear zones, but branches should not be in danger of falling into the road. Improper pruning techniques create undesirable aesthetics and a long-term safety hazard by making trees more susceptible to disease. If a tree must be removed, the trunk and roots must be completely removed with the proper equipment. If the tree is not completely removed, some species can regenerate from their roots or sucker from the trunk.

When to Prune

Trees are best pruned in late winter, the dormant season, before spring growth begins. Not only is it easier to prune when there are no leaves, but it will also allow the wounds to be exposed for only a short time before the new growth helps them seal. Trees and shrubs that bloom early in the season on the previous year’s growth should be pruned after they finish blooming.

Some plants may require more frequent pruning. Shrubs that are planted to form a hedge will need to be pruned twice a year, before spring growth and in mid-summer. Hedges should be pruned so the base is wider than the top. This improves the hedges structure and allows sunlight onto all parts of the plant.

Some plants, such as evergreens, require little to no pruning. Pruning on pines should be limited to removing unhealthy or unsafe branches. Like other plants, evergreens should be pruned in the late winter before new growth. Some evergreens, like junipers and arborvitae, can be pruned through mid-summer, but pruning should be limited to unhealthy or undesired branches.

Trees

At the time of planting, prune only the branches that are dead, broken or severely deformed. In the first year after planting, prune only the sucker sprouts from the base of the tree. All other pruning can be performed, as necessary, one year after planting. Care should be taken to never prune or cut back the central leader.

Tree pruning will be required to meet certain requirements. The Americans with Disabilities Act (ADA) requires tree branches to be cleared to 8 feet above sidewalks. Pruning is also required to remove tree branches that overhang roadways and shoulders as well as branches that obstruct road signs or sight lines.

As the tree matures, some crown thinning may be needed. Crown thinning involves selectively removing branches to improve a tree's form. It also allows more light and air into the tree's crown, promoting healthy growth. When thinning the crown, only remove the weak or unhealthy branches.

If tree pruning is required, follow the instructions for large branches as illustrated in Figure 5.8. This method avoids damage to the tree's bark and leaves a wound that will heal well. For smaller branches or twigs, make a cut back to a side branch or make a cut just above the bud.

Shrubs and Ground Covers

To prune shrubs and ground covers, selectively remove branches to achieve the desired form and maintain the size or shape of the plant. Unless a unique form is desired, pruning should be limited to cutting the tips of the plant. Ground covers do not require much pruning other than branches that encroach into undesirable areas. Some shrubs and ground covers may require pruning to encourage flower and fruit development.

Ornamental Grass

Ornamental grasses have attractive foliage throughout the winter and should not be pruned until the spring. Leaving the foliage throughout the winter also helps insulate the crown of the plant. In the spring before growth resumes, cut back the foliage to approximately 4 to 6 inches. When the dead foliage is removed, spring growth will begin earlier. If foliage is left on the plant, it can delay the crown's warming and subsequent growth by as much as three weeks.

Figure 5.7: Required Tree Canopy Clearance on Walkways

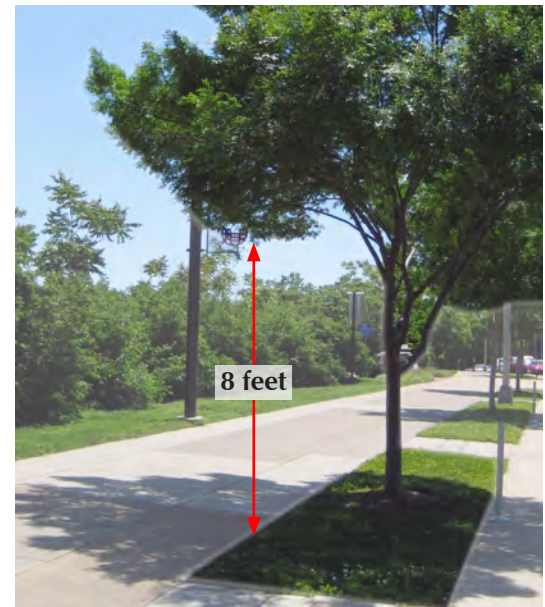
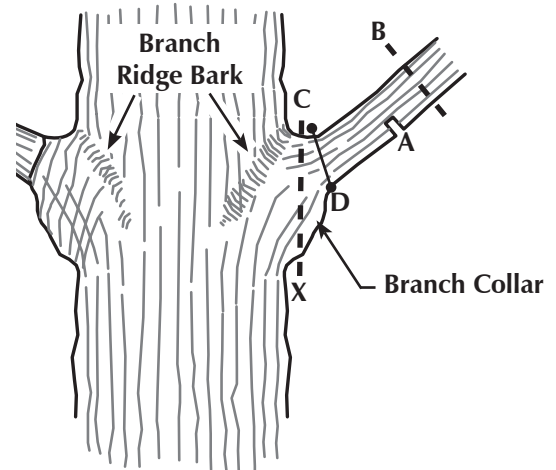


Figure 5.8: Tree Pruning



1. Make first cut at 'A'. Cut part way through branch only.
2. Cut off branch at 'B'.
3. Make final cut at 'C-D', just outside of branch collar.
4. NEVER cut from 'C-X'.

Weed Control

Weeds affect the aesthetics of a planting, disrupt the desired function of the plant material, and compete for space, water and nutrients. Weed control should involve the use of plant culture, and mechanical and chemical vegetation control. Weed control using plant culture includes establishing a solid cover of desired vegetation that chokes out weed growth. Proper plant selection, spacing and soil conditions should reduce long-term weed growth by providing the conditions for plants to grow to their mature size and block the light needed for most weeds to grow.

Some techniques used for erosion prevention may also serve as weed control options. Mulch, filter fabric and cover crops can, at least temporarily, reduce weed growth. Longer-lasting options are available, such as pre-emergent herbicides and chemical or synthetic seed head suppressors recommended in the TDOT Maintenance Division's *Herbicide Recommendations Manual*. Chemicals should only be used if cultural and mechanical methods are ineffective.

LONG-TERM MAINTENANCE

Landscapes have a lifespan. It is necessary to acknowledge this and make adjustments for it, especially when plants near the end of their lifecycle. Old or dying plants take on characteristics that are difficult to manage and contribute to a poor aesthetic. Root suckering and dying branches are common characteristics of old trees.

Include long-term maintenance considerations in your maintenance plan. These should include 5-, 10- and 15-year projections of maintenance needs. Landscapes can be phased out and replaced with different plants, different mowing techniques, or both. New plants can be added to the landscape before the old are removed so the site is never void of vegetation. Existing canopy trees can be useful for starting new plants by protecting them from the harsh sun during the first couple of growing seasons. When the old trees are removed, the new trees have already established.

The Zone 3/no-mow areas, or naturalizing landscapes, should be watched for potential hazard trees but otherwise should be allowed to finish out their lifecycle and be replaced through natural succession. These landscapes will not be visually prominent and will not contribute to poor aesthetics. Large fallen branches or trees that interfere with annual mowing must be removed.

Phasing can be a useful tool for starting landscapes to achieve desired results under tight financial situations. All reasons for phasing out landscapes are most applicable to urban environments where a more controlled image is desired. When considering phasing out or removing plant material, evaluate the plants using the following criteria:

- **Plant Performance:** Is the plant demonstrating the characteristics/performing the function for which it was selected? Is the plant still appropriate for the site? Has it grown too large? Has it become invasive to adjacent areas?
- **Plant Health and Structure:** Is it healthy? Are there signs of disease or pests? Are there any structural weaknesses that might be hazardous?
- **Safety and Maintenance:** Are there conflicts with utilities? Are there conflicts with safety requirements?

If these criteria reveal irresolvable issues, the plant material should be removed and/or replaced.

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Environmental Conditions

Region of State

- West Middle East

USDA Hardiness Zone

- Zone 6a Zone 6b Zone 7a Zone 7b

Light Exposure

- Full Sun Partial Sun Shade

Soil Moisture

- Wet Moist Moist to Dry Dry

Slope

- <10% 10 – 25% >25%

Waterways

- Stream/Creek River Lake

Existing Plant Species

_____	_____
_____	_____
_____	_____
_____	_____

Structures

Drainage Structures

- Inlet
 Headwall(s)
 Culvert(s)
 Swale Width: _____ feet Length: _____ feet
 Detention or Retention Pond
 Other

_____	_____
_____	_____
_____	_____

Utilities

- Overhead Power Lines
 Buried Utilities (gas, water, electrical, sewer, storm water, etc.)
 Utilities Requiring Access Type: _____
 Other

_____	_____
-------	-------

Other Structures

- Pole(s)
- Guardrail or Barrier Type: _____ Length: _____ feet
- Fence Type: _____ Length: _____ feet Height: _____ feet
- Sound wall Type: _____ Length: _____ feet Height: _____ feet
- Bridge Description: _____
- Sign(s)
- Billboard(s)

Safety and Design Requirements

Required Clear Zone(s) (record details and distances below)

Sight Distance (if there are approaches or intersections that require clear sight lines, record details below)

Special Conditions

Viewsheds

- Views to screen
- Views to preserve or open

Cultural and Historical Features

- National, State or Local importance
- National Register of Historic Places
- Other

Notes

Common Name	Scientific Name	Height (feet)	Spread (feet)	USDA Hardiness Zones	Native			Light			Soil Moisture				Salt Spray Tolerant	Urban Tolerant	Evergreen	Fall Color	Flowering	Under Power Lines	Comments
					West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry							
TREES																					
Trident Maple	<i>Acer buergerianum</i>	25 – 35	20 – 30	5 – 8				•				•	•				•		•	•	Good street tree or for plaza areas. Can be used as specimen tree.
Red Maple	<i>Acer rubrum</i>	40 – 60	20 – 40	3 – 9	•	•	•	•	•	•	•	•	•	•				•			Excellent fall color. Good street tree or for plaza areas. Can be used as specimen tree. Several cultivars with various sizes, shapes and color selections.
Sugar Maple	<i>Acer saccharum</i>	60 – 75	40 – 60	4 – 8	•	•	•	•	•	•		•	•				•				Excellent fall color. Good shade tree. Can be used as specimen tree.
Red Horsechestnut	<i>Aesculus x carnea</i>	30 – 40	30 – 40	4 – 7				•	•			•	•						•		Attractive flowers in late spring. Good shade tree or specimen tree.
Yellow Buckeye	<i>Aesculus flava</i>	60 – 75	30 – 40	4 – 8	•	•		•	•			•	•						•		
Red Buckeye	<i>Aesculus pavia</i>	10 – 20	10 – 20	4 – 8	•			•	•	•		•	•						•	•	Can be used as a large shrub. Attractive flowers in spring.
Serviceberry	<i>Amelanchier arborea</i>	15 – 25	15 – 25	4 – 9	•	•	•	•	•	•			•	•				•	•	•	Multi-stemmed small tree or large shrub. Attractive flowers in spring. Excellent fall color. Best used in naturalistic landscapes.
River Birch	<i>Betula nigra</i>	40 – 70	30 – 40	3 – 9	•	•	•	•	•	•	•	•	•								Multi-stemmed. Attractive peeling bark. Tolerates areas that are periodically wet. Good for plaza areas. Can be used as a specimen tree. Best used in naturalistic landscapes.
Hornbeam, Ironwood	<i>Carpinus caroliniana</i>	20 – 30	20 – 30	3 – 9	•	•	•		•	•	•	•	•								
Hackberry	<i>Celtis occidentalis</i>	40 – 60	40 – 60	3 – 9				•				•	•	•	•						Tolerant of adverse conditions. Can be used as a screen.
Redbud	<i>Cercis canadensis</i>	20 – 30	25 – 35	4 – 9	•	•	•	•	•	•		•	•	•					•	•	
Fringetree	<i>Chionanthus virginicus</i>	15 – 25	15 – 25	4 – 9		•	•		•	•		•	•		•				•	•	Tolerant of adverse conditions. Attractive flowers in late spring. Best used in mass plantings, borders and naturalistic landscapes. Can be used as specimen tree or large shrub.
Yellowwood	<i>Cladrastis kentukea</i>	30 – 50	40 – 55	4 – 8	•	•	•	•	•	•		•	•					•	•		Showy flowers, excellent fall color and attractive bark provide year-round interest. Can be used as a specimen tree.
Flowering Dogwood	<i>Cornus florida</i>	15 – 25	15 – 25	5 – 8	•	•	•		•	•		•	•						•	•	Showy flowers, excellent fall color and attractive bark provide year-round interest. Best used in naturalistic landscapes but also has ornamental qualities. Can be used as a specimen tree. Not tolerant of poor conditions or environmental stresses.
American Beech	<i>Fagus grandifolia</i>	50 – 70	50 – 70	4 – 9	•	•	•	•	•	•		•	•					•			Excellent fall color and attractive bark. Best used in large areas and naturalistic landscapes.
Ginkgo	<i>Ginkgo biloba</i>	50 – 80	30 – 40	4 – 8				•					•		•				•		Excellent fall color. Good street tree. Only male plants should be used (female plants produce messy fruit). Several cultivars with various sizes, shapes and color selections.
Thornless Common Honeylocust	<i>Gleditsia traicanthos var. inermis</i>	50 – 60	50 – 60	4 – 9				•				•	•		•				•		Choose thornless variety. Excellent fall color. Fine texture. Good street tree but can be messy.
American Holly	<i>Ilex opaca</i>	40 – 50	20 – 40	5 – 9	•	•	•	•	•	•		•	•		•						Can be used as specimen tree or in groupings. Very effective screen. Has ornamental qualities. Requires male and female plants for a fruit set.

Common Name	Scientific Name	Height (feet)	Spread (feet)	USDA Hardiness Zones	Native			Light			Soil Moisture				Salt Spray Tolerant	Urban Tolerant	Evergreen	Fall Color	Flowering	Under Power Lines	Comments
					West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry							
TREES (continued)																					
Eastern Redcedar	<i>Juniperus virginiana</i>	40 – 50	10 – 20	3 – 9	•	•	•	•	•				•	•	•		•				Can be used as specimen tree or in groupings. Very effective screen. Common in the roadside environment and along fence lines. Tolerant of adverse conditions.
Golden Raintree	<i>Koelreuteria paniculata</i>	30 – 40	30 – 40	5 – 8				•					•	•					•	•	Showy flowers in summer. Good for plaza areas. Can be used as specimen tree where space is limited. Tolerant of adverse conditions.
Common Crapemyrtle	<i>Lagerstroemia indica</i>	varies	varies	7 – 9				•					•				•	•	•		Multi-stemmed small tree or large shrub. Showy flowers, excellent fall color and attractive bark provide year-round interest. Size, color and bloom time varies by cultivar. Several cultivars with various sizes, shapes and color selections. Can be used as specimen tree or in groupings. Good choice for medians.
Sweetgum	<i>Liquidambar styraciflua</i>	60 – 75	30 – 40	5 – 9	•	•	•	•	•	•	•	•	•	•	•				•		Excellent fall color. Best used in large areas. Spiny fruit may become a litter problem in pedestrian areas. Several cultivars with various sizes and shapes.
Tulip Poplar	<i>Liriodendron tulipifera</i>	70 – 90	35 – 50	4 – 9		•	•	•	•				•						•		Tennessee’s state tree. Best used in large areas. Good specimen tree. Fall color can be showy.
Southern Magnolia	<i>Magnolia grandiflora</i>	60 – 80	30 – 50	7 – 9				•	•	•			•	•	•				•	•	Showy flowers in spring and sporadically throughout the season. Can be used as a specimen tree or in groupings. Very effective screen. Best used in large areas but can be used as a street tree, particularly along boulevards/in medians. Several cultivars with various sizes and shapes.
Star Magnolia	<i>Magnolia stellata</i>	15 – 20	10 – 15	4 – 8				•					•						•	•	Multi-stemmed small tree or large shrub. Attractive flowers in early spring. Can be used as a specimen tree or accent plant. Several cultivars with various flower colors and types.
Sweetbay Magnolia	<i>Magnolia virginiana</i>	10 – 20	10 – 20	5 – 9	•	•	•	•	•				•						•		Multi-stemmed small tree or large shrub. Attractive flowers in late spring and sporadically throughout season. Can be used as a specimen tree. Best used in plaza areas and naturalistic landscapes
Dawn Redwood	<i>Metasequoia glyptostroboides</i>	70 – 100	25	5 – 8				•					•								Large, fine texture tree. Attractive bark. Best used in large areas. Can be used as specimen tree. Has ornamental qualities.
Black Tupelo, Black Gum	<i>Nyssa sylvatica</i>	30 – 50	20 – 30	4 – 9	•	•	•	•	•	•									•		Can be difficult to transplant because of tap root. Excellent fall color. Good street tree. Can be used as specimen tree. Best used in naturalistic landscapes.
Sourwood	<i>Oxydendrum arboreum</i>	25 – 30	20	5 – 9	•	•	•	•	•				•	•					•		Excellent fall color. Showy flowers in summer. Has ornamental qualities but is also good for naturalistic landscapes. Can be used as specimen tree.
Shortleaf Pine	<i>Pinus echinata</i>	50 – 60	20 – 35	6 – 9	•	•	•	•											•		Can be difficult to transplant because of tap root. Tolerant of dry soils.
White Pine	<i>Pinus strobus</i>	50 – 80	20 – 40	3 – 7			•	•											•		Fine texture. Can be used as specimen tree or in groupings. Very effective screen. Has ornamental qualities but is also good for naturalistic landscapes.
Virginia Pine	<i>Pinus virginiana</i>	15 – 40	10 – 30	4 – 8	•	•		•											•		Tolerant of dry soils and will cover dry, barren sites.
Sycamore	<i>Platanus occidentalis</i>	75 – 100	75 – 100	4 – 9	•	•	•	•	•				•	•							Large, course texture tree. Attractive bark. Good street tree where space permits. Best used in large areas. Good tree for difficult growing sites. Will tolerate drought conditions.

Common Name	Scientific Name	Height (feet)	Spread (feet)	USDA Hardiness Zones	Native			Light			Soil Moisture				Salt Spray Tolerant	Urban Tolerant	Evergreen	Fall Color	Flowering	Under Power Lines	Comments
					West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry							
TREES (continued)																					
Swamp White Oak	<i>Quercus bicolor</i>	50 – 60	50 – 60	4 – 8				•	•		•	•									Large, coarse texture tree. Will tolerate drought conditions. Best used in large areas. Can be used as specimen tree. Acorns may become a litter problem in pedestrian areas.
Pin Oak	<i>Quercus palustris</i>	60 – 70	25 – 40	4 – 8		•	•	•	•		•	•	•	•				•			
Willow Oak	<i>Quercus phellos</i>	40 – 60	30 – 40	5 – 9	•	•		•	•		•	•	•	•	•			•			Fine texture tree. Good street tree, particularly along boulevards/in medians. Acorns may become a litter problem in pedestrian areas. Best used in large areas.
Red Oak	<i>Quercus rubra</i>	60 – 75	60 – 75	3 – 7	•	•	•	•	•		•	•	•		•			•			Good fall color. Good street tree. Best used in large areas. Acorns may become a litter problem in pedestrian areas.
Staghorn Sumac	<i>Rhus typhina</i>	20 – 30	20 – 30	4 – 8	•	•	•	•	•				•					•		•	Can be used as small tree or large shrub. Excellent fall color. Dark red pyramidal fruit display in late summer. Best used in mass plantings and naturalistic landscapes. Can be used for bank stabilization and will quickly cover slopes, cuts and fills.
Sassafras	<i>Sassafras albidium</i>	30 – 60	25 – 40	4 – 9	•	•	•	•	•			•	•					•			Can be difficult to transplant because of tap root. Excellent fall color. Best used in naturalistic landscapes. Will develop suckers from the roots to form colonies.
Bald Cypress	<i>Taxodium distichum</i>	50 – 70	20 – 30	4 – 11	•			•	•		•	•		•							Large, fine texture deciduous conifer. Attractive bark. Tolerant of wet soils and standing water. Can form root “knees” in wet sites.
White Cedar, Eastern Arborvitae	<i>Thuja occidentalis</i>	40 – 60	10 – 15	3 – 7				•				•	•				•				Can form a hedge. Very effective screen. Can be used as specimen tree. Several cultivars with various sizes, shapes and color selections.
American Elm	<i>Ulmus americana ‘Princeton’</i>	60 – 80	40 – 60	3 – 9				•	•	•		•	•								Good street tree. Choose a cultivar with good resistance to Dutch Elm disease--like ‘Princeton’ or ‘Valley Forge.’
Lacebark Elm	<i>Ulmus parvifolia</i>	40 – 50	40 – 50	5 – 9				•	•	•			•		•						Good street tree. Attractive bark. Several cultivars.
Japanese Zelkova	<i>Zelkova serrata</i>	50 – 80	40 – 60	5 – 8				•				•			•						Good street tree or for plaza areas. Attractive bark. Good alternative for Bradford Pear. Several cultivars.

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					West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry							
SHRUBS																					
Red Chokeberry	<i>Aronia arbutifolia</i>	6 – 10	3 – 5	4 – 9	•	•	•	•	•		•	•	•				•		Alternative for Japanese barberry and winged euonymus. Best used in mass plantings or borders. Can be used for bank stabilization.		
Littleleaf Boxwood	<i>Buxus microphylla</i>	3 – 5	3 – 5	6 – 9				•	•			•				•		Good for hedges and borders. Often used in formal gardens.			
American Beautyberry	<i>Callicarpa americana</i>	3 – 8	6 – 8	6 – 10	•	•	•	•	•		•	•	•	•				Best used in mass plantings and naturalistic landscapes. Very attractive fruit in late fall/early winter.			
Sweetshrub	<i>Calycanthus floridus</i>	6 – 10	6 – 12	4 – 9		•	•	•	•		•	•	•					Good border plant. Fragrant flowers in late spring/early summer. Very resistant to disease and pests.			
New Jersey Tea	<i>Ceanothus americanus</i>	3 – 4	3 – 5	4 – 8	•	•	•	•	•			•	•	•				May be difficult to transplant but is tolerant of adverse conditions. Often found in roadside environment.			
Buttonbush	<i>Cephalanthus occidentalis</i>	5 – 12	4 – 8	5 – 11	•	•	•	•	•		•	•						• Has ornamental qualities. Prefers wet soils and can tolerate poor drainage or standing water.			
Summersweet Clethra	<i>Clethra alnifolia</i>	4 – 8	4 – 6	4 – 9	•	•	•	•	•			•						• Good border plant. Fragrant, showy flowers in summer. Resistant to disease and pests.			
Tatarian Dogwood	<i>Cornus alba</i>	4 – 8	4 – 8	3 – 7				•	•			•						• Best used in mass plantings or borders. Stems are bright red in winter.			
Redosier Dogwood	<i>Cornus sericea</i>	7 – 9	10 – 12	2 – 7				•	•			•						• Best used in mass plantings or borders. Can be used for bank stabilization. Stems are dark red in winter.			
Spreading Cotoneaster	<i>Cotoneaster divaricatus</i>	5 – 6	6 – 8	4 – 7				•	•			•	•				•	• Best used in mass plantings. Can be used as a ground cover.			
Rockspray Cotoneaster	<i>Cotoneaster horizontalis</i>	2 – 3	5 – 8	5 – 7				•	•			•					•	• Best used in mass plantings. Excellent ground cover plant, especially on slopes. Showy flowers in late spring.			
Dwarf Fothergilla	<i>Fothergilla gardenii</i>	2 – 3	2 – 4	5 – 8				•	•			•					•	• Alternative for Japanese spirea and winged euonymus. Best used in mass plantings, borders, foundation plantings and naturalistic landscapes. Excellent fall color and showy flowers. Very resistant to disease and pests.			
Swamp Mallow	<i>Hibiscus moscheutos</i>	4 – 6	3 – 4	5 – 9		•	•	•	•		•							•			
Wild Hydrangea	<i>Hydrangea arborescens</i>	3 – 5	3 – 5	4 – 9		•	•	•	•		•	•						• Good for naturalistic landscape. Very adaptable and fast growing.			
Bigleaf Hydrangea	<i>Hydrangea macrophylla</i>	3 – 6	3 – 6	5 – 9				•	•		•	•						• Excellent border shrub. Very showy flowers.			
Oakleaf Hydrangea	<i>Hydrangea quercifolia</i>	4 – 6	4 – 6	5 – 9	•	•		•	•	•	•	•					•	• Excellent fall color and attractive bark.			
Golden St. John's Wort	<i>Hypericum frondosum</i>	3 – 4	3 – 4	5 – 8		•	•	•	•			•						•			
Chinese Holly	<i>Ilex cornuta</i>	8 – 10	8 – 10	7 – 9				•	•			•	•					• Very showy fruit.			
Japanese Holly	<i>Ilex crenata</i>	6 – 10	6 – 10	5 – 8				•	•			•						• Good for foundation plantings, hedges and mass plantings. Has a finer texture than most hollies.			
Deciduous Holly	<i>Ilex decidua</i>	7 – 15	5 – 12	5 – 9	•			•	•		•	•						• Showy fruit and attractive bark in the winter. Can also be used as a understory tree.			
Winterberry	<i>Ilex verticillata</i>	6 – 10	6 – 10	3 – 9	•	•	•	•	•	•	•	•						• Alternative for Japanese barberry. Best used in mass plantings or borders. Excellent fruit display in fall and winter but must have both a male and female plant to produce berries.			

Common Name	Scientific Name	Height (feet)	Spread (feet)	USDA Hardiness Zones	Native			Light			Soil Moisture					Salt Spray Tolerant	Urban Tolerant	Evergreen	Fall Color	Flowering	Comments
					West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry							
SHRUBS (continued)																					
Virginia Sweetspire	<i>Itea virginica</i>	3 – 5	3 – 5	5 – 9	•	•	•	•	•	•	•	•					•	•	Alternative for Japanese spirea and Japanese barberry. Best used in mass plantings and naturalistic landscapes. Excellent fall color. Can tolerate poor drainage.		
Winter Jasmine	<i>Jasminum nudiflorum</i>	3 – 4	4 – 7	6 – 10				•	•	•		•					•	•	Tolerant of poor soils. Good plant to cover slopes. Fast growing.		
Chinese Juniper	<i>Juniperus chinensis</i>	varies	varies	4 – 9											•		•		Height and spread varies by cultivar. Can be used as ground cover, screen, focal point or foundation planting depending on cultivar.		
Common Juniper	<i>Juniperus communis</i>	5 – 10	8 – 12	2 – 7				•				•	•		•	•	•		Tolerant of adverse conditions. Can be used as a ground cover.		
Mountain Laurel	<i>Kalmia latifolia</i>	5 – 12	5 – 12	4 – 9		•	•	•	•				•	•			•	•	Showy flowers May to June. Prefers cool, well-drained soil. Best in mass plantings, borders and naturalistic landscapes.		
Ninebark	<i>Physocarpus opulifolius</i>	5 – 10	6 – 10	2 – 7		•	•	•	•			•	•	•					•	Tolerant of adverse conditions. Attractive, exfoliating bark.	
Mugo Pine	<i>Pinus mugo</i>	15 – 20	20 – 25	3 – 7				•	•			•		•							
Bush Cinquefoil	<i>Potentilla fruticosa</i>	1 – 4	2 – 4	2 – 7				•	•				•	•	•					•	
Flame Azalea	<i>Rhododendron calendulaceum</i>	4 – 8	10 – 15	5 – 7			•		•	•		•	•						•	Best used in mass plantings and naturalistic landscapes. Showy flowers May to June.	
Fragrant Sumac	<i>Rhus aromatica</i>	2 – 6	6 – 10	3 – 9	•	•	•	•	•				•	•				•	•	Can be used for bank stabilization and will quickly cover slopes, cuts and fills. ‘Gro-Low’ cultivar is excellent ground cover.	
Winged Sumac	<i>Rhus copallina</i>	7 – 15	10 – 20	4 – 9	•	•	•	•	•			•	•	•				•	•	Fast growing. Tolerant of poor soils.	
Bumald Spirea	<i>Spiraea x bumalda</i>	2 – 3	3 – 5	3 – 8				•	•			•	•	•				•	•		
Arrowwood	<i>Viburnum dentatum</i>	6 – 8	6 – 15	3 – 8				•	•				•	•	•				•	Excellent border or hedge plant. Best used in mass plantings.	

Common Name	Scientific Name	Height (feet)	USDA Hardiness Zones	Native			Light			Soil Moisture				Type*		Bloom Time				Comments
				West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry	Annual	Perennial	Spring	Summer	Fall	Winter	
FLOWERS & HERBACEOUS ORNAMENTALS																				
Yarrow	<i>Achillea millefolium</i>	1 – 3	4 – 8	•	•	•	•	•				•	•		•	•	•			White, flat-topped flower clusters. Drought tolerant.
White Baneberry	<i>Actaea pachypoda</i>	1 – 3	3 – 8	•	•	•		•	•		•	•			•	•				White flowers. Produces white berries.
Blue Star	<i>Amsonia tabernaemontana</i>	1 – 3	4 – 9	•	•	•	•	•		•	•				•	•				
Wild Columbine	<i>Aquilegia canadensis</i>	1 – 3	3 – 8	•	•	•		•	•		•				•	•	•			Red, pink and yellow flowers. Drought tolerant. Will spread by self-seeding.
Butterflyweed	<i>Asclepias tuberosa</i>	1.5 – 2	3 – 9	•	•	•	•	•			•	•			•		•			Large clusters of orange flowers. Drought tolerant. Will spread by self-seeding.
Blue Wild Indigo	<i>Baptisia australis</i>	3 – 6	3 – 9	•	•	•	•	•			•	•	•		•		•			Tall spikes of blue-purple flowers. Tolerant of drought and poor soils.
Wax Begonia	<i>Begonia semperflorens</i>	0.5 – 1	--				•	•			•	•		•		•	•	•		Several cultivars with various sizes, color selections and bloom times.
Ornamental Cabbage	<i>Brassica oleracea</i>	varies					•	•			•	•		•						Colorful foliage in fall and winter. Several cultivars with various sizes and color selections.
Caladium	<i>Caladium bicolor</i>	1 – 2.5	--					•	•		•	•		•						Colorful foliage displays from late spring to late summer. Several cultivars with various sizes and color selections. Some cultivars can be grown in full sun.
Chrysanthemums, Mums	<i>Chrysanthemum spp.</i>	2 – 3	3 – 9				•				•	•		•	•				•	Several species and cultivars with various sizes and color selections. Can be annual or perennial depending on growing conditions, species and/or cultivar.
Lanceleaf Coreopsis	<i>Coreopsis lanceolata</i>	1 – 2	4 – 9	•	•	•	•	•			•	•	•		•	•	•			
Plains Coreopsis	<i>Coreopsis tinctoria</i>	1 – 2	4 – 10	•	•	•	•	•			•	•		•		•				Fast-growing. Tolerant of drought and poor soils. Will spread by self-seeding.
Dianthus	<i>Dianthus spp.</i>	varies	varies				•				•	•		•	•	•				Several species and cultivars with various sizes and color selections. Can be annual or perennial depending on growing conditions, species and/or cultivar.
Wild Bleeding Heart	<i>Dicentra eximia</i>	1 – 1.5	3 – 9	•	•	•		•	•		•	•		•	•	•	•			Pink heart-shaped flowers. Will spread to cover an area over time.
Purple Coneflower	<i>Echinacea purpurea</i>	2 – 5	3 – 8	•	•	•	•	•			•	•		•	•	•				Very large purple flowers. Tolerant of drought and poor soils. Will spread by self-seeding.
Joe-Pye Weed	<i>Eupatoriadelphus fistulosus</i>	5 – 7	4 – 9	•	•	•	•				•			•		•				
Gladiolus	<i>Gladiolus spp.</i>	varies	varies				•				•			•			•			Several species and cultivars with various sizes and color selections. Tall spikes of large blossoms in white, pink, red, purple, yellow, orange or salmon.
Daylily	<i>Hemerocallis spp.</i>	varies	varies				•				•	•		•	•	•	•			Several cultivars with various sizes, color selections and bloom times. Drought tolerant.
Alumroot	<i>Heuchera americana</i>	1 – 2	4 – 9	•	•	•		•	•		•	•		•	•	•				Tolerant of poor soils. Can be used as a ground cover.
Impatiens	<i>Impatiens walleriana</i>	0.5 – 2	--				•	•			•			•			•	•		Several hybrids and cultivars with various sizes and color selections. Will bloom from early summer to first frost. Will spread by self-seeding.
Iris	<i>Iris spp.</i>	varies	varies				•	•			•	•		•	•	•				Several species and cultivars with various sizes and color selections.
Dense Blazing Star	<i>Liatis spicata</i>	2 – 4	3 – 8	•	•	•	•				•	•	•		•		•			
Turks-cap Lily	<i>Lilium superbum</i>	4 – 8	4 – 9				•	•			•			•		•				
Cardinal Flower	<i>Lobelia cardinalis</i>	2 – 6	3 – 9	•	•	•		•		•	•			•		•				Will tolerate full sun in cooler environments. Flowers occur in late summer.
Beebalm	<i>Monarda didyma</i>	2 – 4	4 – 9	•	•	•	•	•			•			•	•	•				
Daffodil	<i>Narcissus spp.</i>	varies	3 – 9				•				•	•		•	•			•		Several species and cultivars with various sizes, color selections and bloom times.
Sundrops	<i>Oenothera fruticosa</i>	1 – 2	4 – 8	•	•	•	•				•	•		•	•	•				Drought tolerant. Common in the roadside environment.

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				West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry	Annual	Perennial	Spring	Summer	Fall	Winter	
FLOWERS & HERBACEOUS ORNAMENTALS (continued)																				
Poppy	<i>Papaver</i> spp. or <i>Eschscholzia</i> spp.	varies	varies				•						•	•	•	•	•			Tolerant of drought and poor soils. Will spread in disturbed areas. Certain species are considered invasive.
Petunia	<i>Petunia</i> spp.	0.5 – 1	--				•	•					•				•			Tolerant of poor soils. Will bloom from late spring to first frost. Several species and cultivars with various sizes, color selections and growth habits. Some species and cultivars can be used as a ground cover.
Meadow Phlox	<i>Phlox maculata</i>	2 – 3	4 – 8			•	•	•					•				•	•		
Garden Phlox	<i>Phlox paniculata</i>	3 – 4	4 – 8	•	•	•	•	•					•				•	•		Good alternative for Dame’s Rocket.
Jacob’s Ladder	<i>Polemonium reptans</i>	1 – 1.5	3 – 8	•	•	•		•	•				•	•						
Yellow Coneflower	<i>Ratibida pinnata</i>	3 – 5	3 – 8	•	•	•	•	•					•				•			Tolerant of poor, dry soils.
Black-eyed Susan	<i>Rudbeckia fulgida</i>	2 – 3	3 – 9			•	•						•	•			•	•		
Black-eyed Susan	<i>Rudbeckia hirta</i>	2 – 3	2 – 11	•	•	•	•	•					•	•	•		•	•		Can be annual or perennial depending on growing conditions. Drought tolerant. Common in the roadside environment. Will spread by self-seeding.
Scarlet Sage	<i>Salvia splendens</i>	0.5 – 1	--				•	•					•	•			•	•		Remove old flower spikes to produce growth and more flowers.
Coleus	<i>Solenostemon</i> spp.	varies	--				•	•					•							Several species and cultivars with various sizes and color selections.
Stokes Aster	<i>Stokesia laevis</i>	1 – 2	5 – 10				•	•					•				•			Can be used as a ground cover.
Marigold	<i>Tagetes</i> spp.	varies	varies				•						•				•	•		Several species and cultivars with various sizes, color selections and bloom times.
Carolina Bushpea	<i>Thermopsis villosa</i>	3 – 5	4 – 9	•	•	•	•	•					•	•						Tall spikes of yellow flowers.
Tulip	<i>Tulipa</i> spp.	varies	3 – 7				•	•					•	•						Several species and cultivars with various sizes, color selections and bloom times.
Verbena	<i>Verbena x hybrida</i>	0.5 – 1	--				•	•					•				•	•		Will bloom into early fall. Several cultivars with various color selections.
Pansy	<i>Viola</i> spp.	varies	--				•	•					•				•	•	•	Several cultivars and hybrids with various sizes, color selections and bloom times. Remove dead flowers to extend the blooming period.
Zinnia	<i>Zinnia</i> spp.	varies	--				•						•		•		•	•		Several species and cultivars with various sizes and color selections. Will bloom from early summer to first frost. Drought tolerant.

*Plant type (annual or perennial) may depend on growing conditions. This chart reflects whether the plant is an annual or perennial in Tennessee.

Common Name	Scientific Name	Height	USDA Hardiness Zones	Native			Light			Soil Moisture				Bloom Time				Comments
				West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry	Spring	Summer	Fall	Winter	
GRASSES																		
Big Bluestem	<i>Andropogon gerardii</i>	4 – 8	4 – 9	•	•	•	•	•				•	•		•		Tolerant of drought.	
Bushy Beardsglass	<i>Andropogon glomertus</i>	2 – 5	5 – 9	•	•	•	•				•	•			•	•		
Splitbeard Bluestem	<i>Andropogon ternarius</i>	1.5 – 5	6 – 9			•	•	•				•	•		•	•	Tolerant of drought. Can be used as a nurse crop for slower establishing native species.	
Broomsedge	<i>Andropogon virginicus</i>	2 – 5	5 – 8		•	•	•	•			•				•		Can be used for erosion control. Will spread throughout disturbed areas.	
Giant Cane	<i>Arundinaria gigantea</i>	5 – 15	5 – 9	•	•	•	•	•		•	•			•		•	Native to riverbanks and moist bottomlands. Best used as a dense hedge or screen. Helps control soil erosion.	
Sideoats Grama	<i>Bouteloua curtipendula</i>	2 – 3	4 – 9	•	•	•	•	•				•	•		•	•		
Feather Reed Grass	<i>Calamagrostis x acutiflora</i> ‘Karl Foerster’	3 – 5	5 – 9				•			•	•				•		Ornamental grass that grows in clumps and has an upright, slightly arching form. Offers year-round interest. Best used in mass plantings, in borders or as a specimen. The plant grows slow-spreading and will not self-seed. Flower stalks will grow to 6 feet in height and have purple-green flowers.	
River Oats	<i>Chasmanthium latifolium</i>	2 – 4	3 – 8	•	•	•	•	•	•	•	•				•		Ornamental seed heads add good texture and year-round interest to landscape beds.	
Common Bermuda Grass	<i>Cynodon dactylon</i>	--	8 – 11				•			•	•						Used as a turf/lawn grass. Should only be used in West Tennessee. Tolerant of short periods of drought.	
Canada Wildrye	<i>Elymus canadensis</i>	2 – 4	3 – 8		•	•	•				•	•		•			Arching spikes add fine texture to landscape. Turns tan in fall. Best used in naturalistic landscapes.	
Bottlebrush Grass	<i>Elymus hystrix</i> (or <i>Hystrix patula</i>)	2 – 3	5 – 9		•	•	•	•			•	•		•				
Virginia Wildrye	<i>Elymus virginicus</i>	2.5 – 4	3 – 8	•	•	•	•	•			•	•		•			Good for stabilizing disturbed soils.	
Kentucky 31 Tall Fescue	<i>Festuca arundinacea</i> ‘Kentucky 31’	--	2 – 7				•				•						Used as a turf/lawn grass. Tolerant of short periods of flooding as well as drought. Should be used in Middle and East Tennessee.	
Bule Oat Grass	<i>Helictotrichon sempervirens</i>	2 – 3	4 – 8				•				•	•		•			Tolerates partial shade but does best in full sun. Foliage has a blue tint that is most vibrant in dry soils. Ornamental grass that grows in small clumps. Best used in mass plantings, in borders, as an accent or as a specimen. Can be used as a ground cover.	
English Ryegrass	<i>Lolium perenne</i>	--	3 – 7				•				•	•					Used as a turf/lawn grass.	
Maiden Grass	<i>Miscanthus sinensis</i>	5 – 6	4 – 9				•				•	•			•		Ornamental grass that grows in clumps and spreads up and out like a fountain. Offers year-round interest. Best used in mass plantings, in borders or as a screen. The plant grows aggressively and will spread, so it should be used in contained areas. Several cultivars with various size, color and texture options. ‘Gracillimus’ has a finer texture and an upright growth habit from 5–8 feet tall. ‘Purpurescens’ has reddish foliage in the summer and purple-red foliage in the fall.	
Switch Grass	<i>Panicum virgatum</i>	3 – 6	5 – 9	•	•	•	•	•		•	•					•	Will spread by rhizomes or through self-seeding. Best used in mass plantings, in borders or as a screen. Appropriate for naturalistic landscapes. ‘Heavy Metal’ cultivar features metallic-blue foliage and a columnar form.	

Common Name	Scientific Name	Height	USDA Hardiness Zones	Native			Light			Soil Moisture				Bloom Time				Comments
				West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry	Spring	Summer	Fall	Winter	
GRASSES (continued)																		
Fountain Grass	<i>Pennisetum alopecuroides</i>	2.5 – 5	6 – 9				•	•			•	•				•	Ornamental grass that grows in clumps and spreads up and out like a fountain. Offers year-round interest. Best used in mass plantings, in borders or as a specimen. The plant grows aggressively and will spread, so it should be used in contained areas. Several cultivars with various size, color and texture options. ‘Hameln’ is a dwarf form of the species and grows 1.5–2.5 feet tall. ‘Cassian’ is another dwarf form of the species with excellent fall color. ‘Moudry’ grows 2–5 feet tall and has dark purple-black flower spikes.	
Oriental Fountain Grass	<i>Pennisetum orientale</i>	2.5 – 6	5 – 8				•				•			•	•		Ornamental grass that grows in clumps and spreads up and out like a fountain. Offers year-round interest. Best used in mass plantings, in borders, as a screen or as a specimen. Has excellent fine texture. Several cultivars with various size, color and texture options. ‘Tall Tails’ grows much larger than the species and has attractive flower spikes. ‘Karley Rose’ has a deeper green foliage and rose-pink flower spikes that begin to appear in mid-summer and continue into the fall.	
Little Bluestem	<i>Schizachyrium scoparium</i>	2 – 4	3 – 9	•	•	•	•	•				•	•			•	•	Best used in mass plantings. Turns bronze-orange in fall.
Indian Grass	<i>Sorghastrum nutans</i>	3 – 5	4 – 9	•	•	•	•					•	•			•	•	Best used in mass plantings. Tolerates poor, dry soils.
Eastern Gamagrass	<i>Tripsacum dactyloides</i>	4 – 8	4 – 9	•			•	•			•			•	•			

Common Name	Scientific Name	Height (feet)	USDA Hardiness Zones	Native			Light			Soil Moisture				Evergreen	Fall Color	Flowering	Comments		
				West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry						
GROUND COVERS																			
Pussytoes	<i>Antennaria plantaginifolia</i>	0.5 – 1	3 – 8	•	•	•	•						•	•	•	•	Tolerant of drought. Good ground cover for dry woodland landscapes with full sun or partial shade.		
Wild Ginger	<i>Asarum canadense</i>	0.5 – 1	4 – 6	•	•	•		•	•			•	•				•	Good ground cover for woodlands and shaded landscapes. Best used in naturalistic landscapes	
Blue Wood Aster	<i>Aster cordifolius</i>	2 – 5	3 – 8			•	•	•					•	•				•	Good option for shade gardens and naturalistic landscapes. Will attract butterflies.
Green and Gold	<i>Chrysogonum virginianum</i>	0.5 – 1	5 – 9	•	•	•		•	•	•	•							•	Low-growing perennial that forms a foliage mat and produces star-shaped, bright yellow flowers. Can be used as an edging/border plant, in woodland gardens and in naturalistic landscapes.
Golden Star	<i>Chrysogonum virginianum var. australe</i>	0.5 – 1	5 – 9	•	•	•		•	•	•	•							•	Low-growing perennial that forms a foliage mat and produces star-shaped, bright yellow flowers. Can be used as an edging/border plant, in woodland gardens and in naturalistic landscapes. Spreads more rapidly by above-ground stolons and is more prostrate than <i>Chrysogonum virginianum</i> . Semi-evergreen.
Mouse-eared Coreopsis, Lobed Tickseed	<i>Coreopsis auriculata</i>	0.5 – 2	5 – 9		•	•	•	•				•	•					•	Needs 3-4 hours of sunlight a day for best results. Has a dwarf, compact growth habit. Spreads to form colonies. The cultivar ‘Nana’ is 6-9 inches tall and has bright orange-yellow daisy-like flowers.
St. John’s Wort	<i>Hypericum calycinum</i>	1 – 2	5 – 8				•	•	•			•						•	Grows quickly to cover areas in a short time. Attractive yellow flowers.
Shrubby St. John’s Wort	<i>Hypericum prolificum</i>	1 – 4	4 – 8	•	•	•	•	•				•	•	•				•	
Shore Juniper	<i>Juniperus conferta</i>	1 – 2	6 – 9				•						•	•	•				Best used in mass plantings. Good ground cover for erosion control and roadside plantings. Several cultivars with various size and color options. ‘Blue Pacific’ has blue-green foliage, a tight growth habit and is less than 1 foot tall. ‘Irozam’ is tolerant of harsh, dry conditions and has an upright growth. ‘Silver Mist’ has dense, silvery blue-green foliage that develops a slight purple cast in winter.
Creeping Juniper	<i>Juniperus horizontalis</i>	1 – 2	4 – 9				•						•	•	•				Excellent ground cover for slopes. Very tolerant of adverse conditions. Several cultivars with various size and color options. ‘Plumosa Compacta’ is a dwarf form with a dense, flat growth habit and gray-green foliage that deepens to purple in the winter. ‘Wiltoni’ (also known as ‘Blue Rug’) forms a dense mat of blue foliage 4-6 inches high and turns slightly purple in the winter.
Garden Juniper	<i>Juniperus procumbens ‘Nana’</i>	0.5 – 1	4 – 9				•						•	•	•				Best used in mass plantings. Good ground cover for slopes. Tolerates hot, dry locations in full sun.
Liriope	<i>Liriope muscari</i>	1 – 1.5	5 – 10				•	•				•						•	Tolerates a wide variety of light and soil conditions, heat, and drought. Will spread aggressively and should be planted in contained areas. Best used in mass plantings as an edging/border plant or to cover large areas. Has spikes of purple flowers and produces blackish berries that persist into winter. The cultivar ‘Big Blue’ is 1-2 feet tall. ‘Monroe White’ has white flowers.
Wood Sorrel	<i>Oxalis violacea</i>	0.5 – 1	5 – 9	•	•	•	•	•					•	•				•	Spreads rapidly by runners from its bulbs. Best used in mass plantings in naturalistic landscapes. Flowers range from pink to lavender to violet. Blooms in late spring but may bloom again in the fall with the return of cool weather.

Common Name	Scientific Name	Height (feet)	USDA Hardiness Zones	Native			Light			Soil Moisture				Evergreen	Fall Color	Flowering	Comments
				West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry				
GROUND COVERS (continued)																	
Allegheny Spurge	<i>Pachysandra procumbens</i>	0.5 – 1	6 – 8	•	•	•		•	•					•		•	Will form a dense and solid carpet of vegetation. Foliage is blue-green. Has showy pink-white flowers that bloom in the mid-spring. Excellent ground cover for shaded areas, erosion control and naturalistic landscapes.
Phlox	<i>Phlox divaricata</i>	0.5 – 1	3 – 8					•	•			•				•	
Downy Phlox	<i>Phlox pilosa</i>	1 – 2	4 – 9	•	•	•	•	•					•	•		•	
Creeping Phlox	<i>Phlox stolonifera</i>	0.5 – 1	5 – 9			•	•	•				•	•			•	Spreads to form large colonies and is native to wooded areas and stream banks. Tolerant of shade. Best used in naturalistic landscapes. Flowers vary from white to blue to purple.
American Ipecac	<i>Porteranthus stipulatus</i>	2.5 – 3	4 – 8	•	•	•		•	•			•	•		•	•	Best used in mass plantings and naturalistic landscapes. Turns bronze-red in the fall.
Foam Flower	<i>Tiarella cordifolia</i>	0.5 – 1	4 – 9		•	•		•	•			•		•	•	•	Spreads rapidly by runners to form dense clumps of foliage. Turns bronze-red in the fall. Best used in mass plantings, as a border, moist areas along stream banks and naturalistic landscapes.

Common Name	Scientific Name	Height (feet)	USDA Hardiness Zones	Native			Light			Soil Moisture				Evergreen	Fall Color	Flowering	Comments
				West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry				
VINES																	
Groundnut	<i>Apios americana</i>	8 – 20	4 – 8	•	•	•		•	•	•	•						• Climbing vine with maroon or reddish-brown flowers.
Dutchman’s Pipe	<i>Aristolochia macrophylla</i>	15 – 30	4 – 8			•	•	•			•						• Woody, climbing vine that is typically found along streams. Has large, deep green foliage and large flowers. Will quickly cover trellises, arbors, fences and walls.
Crossvine	<i>Bignonia capreolata</i>	20 – 50	6 – 9	•	•	•	•	•			•		•				• Can be used as a climbing vine or a ground cover. Tolerant of brief flooding. Semi-evergreen with glossy leaves that are dark green in the summer and change to red-purple in the winter. Large trumpet-shaped orange flowers.
Trumpet Creeper	<i>Campsis radicans</i>	20 – 50	4 – 9	•	•	•	•	•		•	•	•					• Woody, climbing vine that attaches itself to structures using aerial rootlets. Grows rapidly and needs a sturdy structure to support it. Will cover fences, trellises, arbors, walls or other structures in the landscape. Can be used as a ground cover. Tolerant of hot, dry sites.
American Bittersweet	<i>Celastrus scandens</i>	15 – 20	3 – 8	•	•	•	•	•			•	•	•				• Deciduous, twining vine with showy red berries. Can be used as a ground cover. Will quickly cover fences, trellises, walls and other structures in the landscape. Excellent fruit display but must have both a male and female plant to produce berries. Best used in naturalistic landscapes.
Purple Clematis	<i>Clematis pitcheri</i>	10 – 15	5 – 9	•	•	•	•	•			•						• Purple urn-shaped flowers. Fairly tolerant of heat and drought. Dies back to the ground in the fall. Stems should be supported or tied to a trellis.
Clematis	<i>Clematis spp.</i>	varies	4 – 8				•	•			•	•					• Several species and cultivars with various sizes and color selections. Can be grown on walls, arbors, fences and trellises.
Virgin’s Bower	<i>Clematis virginiana</i>	10 – 20	3 – 8	•	•	•	•	•		•	•						• Deciduous, twining vine with fragrant flowers. Will rapidly cover trellises, fences and arbors. Can be used as a ground cover. Grows very aggressively and will cover other vegetation if not monitored.
Wood Vamp	<i>Decumaria barbara</i>	10 – 20	6 – 9	•	•	•		•			•						• Can be used as a ground cover but will not bloom when trailing on the ground. Will grow on trees, fences and trellises. Native to stream banks and tolerant of periodic flooding.
Carolina Yellow Jasmine	<i>Gelsemium sempervirens</i>	10 – 20	6 – 9	•	•	•	•				•		•				• Tendril-climbing vine with dark green foliage and large showy yellow flowers. Typically found in open thickets and along roadways. Will tolerate light shade but best flowering occurs in full sun.
Climbing Hydrangea	<i>Hydrangea anomola spp. Petiolaris</i>	30 – 50	4 – 8					•	•		•						• Woody, climbing vine that attaches itself to structures using aerial rootlets. Somewhat intolerant of hot and humid conditions. Can be grown on walls, arbors, fences and trees. Can also be used as a ground cover in shady areas or on steep embankments. Attractive flowers and bark offer year-round interest.
Trumpet Honeysuckle	<i>Lonicera sempervirens</i>	10 – 20	4 – 9	•	•	•	•				•		•				• High climbing, twining vine. Can be used as a ground cover. Showy, trumpet-shaped flowers, exfoliating bark and glossy foliage offer year-round interest. Will grow on trellises, fences and arbors.
Virginia Creeper	<i>Parthenocissus quinquefolia</i>	20 – 50	3 – 9	•	•	•	•	•	•		•			•			• Woody, tendril-climbing vine that does not need support. Can be used as a vine or a ground cover. Tolerates full shade and a wide range of soil and environmental conditions. Excellent for covering walls, trellises, arbors or fences. Can be used as a ground cover and for erosion controls on slopes.

Common Name	Scientific Name	Height (feet)	USDA Hardiness Zones	Native			Light			Soil Moisture				Evergreen	Fall Color	Flowering	Comments
				West TN	Middle TN	East TN	Full Sun	Partial Sun/Shade	Shade	Wet	Moist	Moist to Dry	Dry				
VINES (continued)																	
Purple Passionflower	<i>Passiflora incarnata</i>	6 – 8	5 – 9	•	•	•	•	•				•	•	•			• Herbaceous, tendril-climbing vine that can be used as a ground cover. Fast-growing with very showy flowers. It is Tennessee’s state flower.
American Wisteria	<i>Wisteria frutescens</i>	15 – 30	5 – 9	•	•	•	•	•				•					• Woody, deciduous climbing vine with drooping clusters of purple flowers. Full sun is needed for best flowering. Requires regular pruning to control size of plant. Often used in ornamental plantings. Tolerates periodic flooding. Good vine for growing on arbors, trellises, posts, fences and walls. The cultivar ‘Nivea’ has white flowers.

REFERENCES AND WORKS CITED

- A Policy on Geometric Design of Highways and Streets. 5th ed. Washington, DC: American Association of State Highway Transportation Officials, 2004.
- AASHTO. "Transportation: Cultivating Wildflowers and Native Vegetation on America's Roadsides." American Association of State Highway and Transportation Officials. 16 Sept. 2003. American Association of State Highway and Transportation Officials. 20 June 2008 <<http://downloads.transportation.org/highroad/HighRoad-12.pdf>>.
- American Standard for Nursery Stock (ANSI Z60.1-2004). Washington, DC: American Nursery & Landscape Association (ANLA), 2004.
- Appleton, Bonnie, Vickie Greene, Aileen Smith, and Susan French. "Trees and Shrubs That Tolerate Saline Soils and Salt Spray Drift." Jan. 2003. Virginia Cooperative Extension. <www.ext.vt.edu/pubs/trees/430-031/430-031.html>.
- Booth, Norman K. Basic Elements of Landscape Architectural Design. Prospect Heights, Illinois: Waveland Press, Inc., 1983.
- Brand, Mark H. "Plant Pages." UConn Plant Database for Trees, Shrubs and Vines. University of Connecticut. <www.hort.uconn.edu/plants/index.html>.
- "Census 2000 Urban and Rural Classification." United States Census 2000. 6 July 2007. U.S. Census Bureau. <www.census.gov/geo/www/ua/ua_2k.html>.
- Center For Environmental, comp. "Chapter 10: Roadside Management and Maintenance: Beyond Vegetation." Center for Environmental Excellence by AASHTO. 2008. Center for Environmental Excellence by the American Association of State Highway and Transportation Officials (AASHTO). 20 June 2008 <http://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/10_1.aspx>.
- Dirr, Michael A. Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. Fifth ed. Champaign, Illinois: Stipes, LLC, 1998.
- Federal Highway Administration. "Vegetation Control for Safety: A Guide for Street and Highway Maintenance Personnel." United States Department of Transportation. United States Department of Transportation. 20 June 2008 <www.fhwa.dot.gov/tfhrc/safety/pubs/90003/90003.pdf>.
- Flexibility in Highway Design. U.S. Department of Transportation Federal Highway Administration. <www.fhwa.dot.gov/Environment/flex/index.htm>.
- "Frequently Asked Questions About Tree Care." Tree Care Industry Association (TCIA). <http://128.241.193.252/Public/About_faq_treecare.htm>
- Grades and Standards for Tennessee Trees. Tennessee Department of Agriculture (Forestry Division), Tennessee Urban Forestry Council, and Tennessee Tech University. First ed. 2006.

REFERENCES AND WORKS CITED

- Henderson, Kirk. "Integrated Roadside Vegetation Management: a Quick Glance Around the Country." Forester Communications, Inc. Apr. 2000. 20 June 2008 <www.erosioncontrol.com/april-2000/roadside-vegetation-management.aspx> .
- Keating, Janis. "Trees: The Oldest New Thing in Stormwater Treatment?" Forester Media, Inc. 2002. 20 June 2008 <www.stormh2o.com/march-april-2002/trees-stormwater-treatment.aspx> .
- Keating, Janis. "What's Ahead for Roadsides?" Forester Communications, Inc. Sept.-Oct. 2001. 20 June 2008 <www.erosioncontrol.com/september-october-2001/whats-ahead-roadsides.aspx> .
- "Kick the Invasive Exotic Gardening Habit with Great Native Plant Alternatives." The United States National Arboretum, 18 Mar. 2005. Web. 30 July 2009. <www.usna.usda.gov/Gardens/faqs/InvasivesAlternatives.html> .
- Kopp, Glenn E., and Stentz Alan, comps. "Plant Finder." Kemper Center for Home Gardening. Missouri Botanical Garden. <www.mobot.org/gardeninghelp/plantinfo.shtml> .
- Kramer, Mark L., and Carrieann Paukowits, comps. "USDA Plant Hardiness Zone Map." American Horticultural Society. Mar. 2003. United States Department of Agriculture. <www.ahs.org/pdfs/USDA_Map_3.03.pdf> .
- Landscaping with Native Plants: East Tennessee. Tennessee Exotic Pest Plant Council (TN-EPPC).
- Landscaping with Native Plants: Middle Tennessee. Tennessee Exotic Pest Plant Council (TN-EPPC).
- Landscaping with Native Plants: West Tennessee. Tennessee Exotic Pest Plant Council (TN-EPPC).
- Lynch, Kevin, and Gary Hack. Site Planning. 3rd ed. Cambridge, Massachusetts: The MIT P, 1984.
- "Native Plant Information Network." Lady Bird Johnson Wildflower Center - The University of Texas at Austin. 30 July 2009 <www.wildflower.org/explore/> .
- "Native Plant Selector." Tennessee Valley Authority. <www.tva.gov/river/landandshore/stabilization/plantsearch.htm> .
- Rhodus, Dr. Tim. "OSU Pocket Gardener." Department of Horticulture and Crop Science. The Ohio State University. <<http://hcs.osu.edu/pocketgardener>> .
- Roadside Design Guide. 3rd ed. Washington, DC: American Association of State Highway Transportation Officials, 2006.
- Shelton Group. TDOT Statewide Stakeholders Survey Results. Tennessee Department of Transportation. August 2005.
- Simpson, Tom, and Wayne K. Clatterbuck. "Trees to Plant under Power Lines." Trees for Tennessee Landscapes: Choosing the Right Tree. July 2003. Agricultural Extension Service: the University of Tennessee. <www.utextension.utk.edu/publications/spfiles/SP611.pdf> .

- Street Tree Planting and Establishment Guidelines. Portland Online. Official Web Site for the City of Portland, Oregon. 20 June 2008. <www.portlandonline.com/index.cfm?a=164329&c=42010>.
- "Tennessee Invasive Exotic Plant List." Tennessee Exotic Pest Plant Council. May 2001. <www.tneppc.org>.
- United States. Federal Highway Administration Office of Highway Safety. United States Department of Transportation. FHWA-RT-90-003: Vegetation Control for Safety: A Guide for Street and Highway Maintenance Personnel.
- Wasowski, Sally, and Andy Wasowski. Gardening with Native Plants of the South. Dallas, Texas: Taylor Company, 1994.
- Weiskotten, Kurt. "Draft Guidelines for the Development of Conservation Alternative Mowing Plans for Interstate, Expressway and Parkway Roadsides." International Conference on Ecology and Transportation. 2003. NYDOT. 20 June 2008 <www.icoet.net/downloads/03Birds&Insects.pdf>.

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