

806 TREES, SHRUBS, AND PLANTS

806-1 Description

Trained and experienced personnel should perform inspection of all roadside plantings. Recognizing that this is not always possible, this section is written to serve as a guide for project personnel. It is not intended as a substitute for professional assistance. When questions concerning adequacy of planting stock and procedures are encountered, or when differences of opinion concerning the acceptance or rejection of plants occur and the answers are not readily found in this section, the Inspector should request the assistance of the landscape specialist, landscape architect, or horticulturist. In cases where insect damage and diseases are suspected, the services of an entomologist or plant pathologist may be required.

The highway right-of-way is largely a construction-disturbed environment, lacking in natural soil profiles and subject to unusual run-off, abnormal air turbulence, pollutants, temperature variations, and other extremes. In this environment the designer is faced with providing appropriate highway vegetation.

Functional plantings serve to improve traffic guidance, reduce headlight glare, provide safety features, reduce pollution, provide view and wind screening, control erosion, act as a sound barrier, and contribute to improved aesthetic values. The interest and variety created by imaginative planting design are important aesthetic values. Plantings can also be used to create a smooth transition from rigid geometric cross section and structural forms to nearby natural vegetation and land forms.

Of concern is the survival of plants under the conditions imposed by the design and the environmental conditions of the site. The best conceived and designed planting may not produce the desired results if the quality of plants and the planting procedures fail to meet the specifications.

The Arizona Revised Statutes 32-142, "Public Works", requires that "Drawings, Plans, Specifications, and estimates for public works of the State or a public subdivision thereof involving architecture, engineering, assaying, geology, landscape architecture, or land surveying shall be prepared by or under the direction of and the construction of such works shall be executed under the direct supervision of a qualified registrant within the category involved." Therefore, before commencing any work, there should be a meeting with the Resident Engineer, the landscape specialist, his Inspectors, and the Landscape Architect. The agenda for the meeting scheduled by the Resident Engineer should include, but not be limited to, the following:

- The basic concept of what is to be achieved with each individual area and the project as a whole. (Revegetation, open forest, screening, focal attention, and all other aspects to be discussed must be understood if the ultimate concept of design is to be accomplished.)
- The growing characteristics, weaknesses, and strong points of each plant should be discussed especially as they relate to the environment over which the Inspector has some control (drainage, exposure, etc.). Modifications of the plans should be discussed with the landscape architect.
- Discuss possible maintenance problems with maintenance personnel. Modifications that were unexpected during design may need to be implemented. At the initial layout stage, maintenance personnel may be better qualified to discuss the project. Any modifications to the plans should be coordinated with the Landscape Architect to ensure that the design concept is maintained.

806-2 Materials

Certificate of Compliance is required for all Contractor furnished materials. Materials on landscaping projects include many items besides plant material, such as planting media, pesticides, fertilizer, mulch, staking and

guying material, irrigation/electrical material (pipe, pumps, sprinklers, backflow control devices, valves, etc.), drainage, surfacing, and more. The appropriate section of this manual covers the inspection and testing of the more common highway construction material encountered.

Plant Material: Sampling of plant materials must be done with judgment. Look the entire lot over, carefully noting the general size differential, coloring, the sturdiness, the shapes, leaf dropping on evergreens, condition of bare root, bare root drying, denseness of bare root hair and fibrous root system, firmness of the ball for B&B, general size of balls, root development, wrapping method, evidence of handling methods, and all items of emphasis pointed out in the Plans and Specifications.

Planting Media: Various additives are used to improve the root growing environment of that soil that exists on the site (such items as shredded bark, sand, gravel, sawdust, peat, etc.). The additives may be either used singularly or in combination with the existing soil. A homogeneous blend of the materials specified is a must and can be checked by lab analyses if necessary.

Pesticides: Pesticides should be applied with caution, by a licensed applicator. The label should be checked for the proper material and timing of application. The label also indicates if the material is registered for use on a particular type of plant material. Appropriate pesticide application records will be completed and distributed by the Project Engineer to the designated recipients on each contract where a pesticide is used.

Fertilizers: Fertilizers should be applied in accordance with the specifications. The formula should be cross checked with the specifications and the label on the bag or container. When water-soluble nitrogen fertilizers are used, particularly in lawn areas, adequate moisture is needed to prevent fertilizer burning.

Drainage: Drainage materials include gravel backfill, culvert piping, French drains, etc. These drainage items should be checked as to function and compliance with the Standard Specifications.

806-2.01 Nursery Stock

An inspection of planting stock should be made at the nursery or other approved source to ensure the quality of planting stock. Someone with horticultural expertise should accomplish the inspection.

The size and quality of planting stock cannot be rigidly standardized because of varying growing conditions. Judgment should be exercised and allowances made for reasonable variation in growth and appearance.

All planting stock should be of the genus, species, variety, and sizes specified and shall conform to the Contract Specifications for the particular species, or variety, regarding straightness of trunk, branching structure, proportion, health, and size of material.

Individual plants should be measured to determine conformance with contract. If a particular detail or measurement has not been specified, the current edition of *Arizona Nursery Association Grower's Committee Recommended Tree Specifications* should be used.

Inspection at the nursery or other source of supply should include:

1. Check the general condition of the plant in the block from which the stock is to be taken for:
 - A. Uniformity of Leaf Coloration. Plants that exhibit yellowing or discoloration could indicate poor drainage, fertilizer deficiency, herbicide damage, insect damage, or disease, and may not meet specifications.
 - B. Bud Development. During dormant periods of the growth cycle plants should have buds that

are firm, moist and uniformly spaced. A slight cut may be made into the bark to determine that the cambium (growing layer just beneath the bark) is moist and green.

- C. Uniformity of Growth. The plants in any given block should exhibit uniform vigor and health. Plants that do not conform may not be acceptable.
- D. Spacing of Plants in the Row. Vigorous growing, well rounded, fully developed plants will transplant well. Quality nursery stock should be grown with sufficient spacing to permit good development of the individual plant. Plants grown too close together may be extremely high headed.
- E. Presence of Weeds. An overgrown, weed-infested nursery block indicates lack of care and the plants growing in it may be in a poor state of vigor because of the weed competition. Weeds should not be growing in containers.

2. Check individual plants for freedom of defects such as:

- A. Decay. On trees, look for spots of decayed tissue on the trunk and branches.
- B. Sun Scald or Sunburn. The destruction of tissue caused by the sunrays striking a plant on the south or southwest side. This may result in the death of cambium tissue and bark, exposing the plant to secondary insect and/or disease infestation.
- C. Abrasions of the Bark. Abrasions severe enough to damage the cambium tissue may be sufficient for rejection.
- D. Girdling Roots. Roots that grow around another root or a stem, thus tending to strangle the plant.
- E. Improper Pruning. Stubs resulting from improper pruning, which have died back, are an excellent point of entry for disease organisms. All cuts should be flush with the trunk or supporting branch. When a cut is made to encourage branching, it should be made back to a bud.
- F. Frost Cracks. Long vertical splits in the bark and/or wood may occur on the south and southwest sides of young and thin barked trees. Such cracks may become invaded by canker or decay producing fungi and bacteria.
- G. Signs of Injury. Dead leaves; dry buds; dieback of twigs and branches; blackened sapwood and sunken, discolored patches of bark (sun scald) on the trunk or limbs.
- H. Root Ball. Roots should be all through the container so the root ball stays together during planting.

3. Check individual plants for freedom from plant diseases and pests such as:

- A. Diseases. These will appear in a variety of forms such as abnormal growth of collar, leaves, twigs, fruits, discoloration of leaves and bark, unusual discharges of sap through the bark, etc. Any plant showing evidence of disease should be rejected.
- B. Insects. Look for insect eggs, spider webs or evidence of damage from insect feeding on leaves, twigs, buds, or other plant parts. Examine the trunks of trees for borer holes that appear as tunnels drilled into the bark and inward into the wood of the trunk. Trees with evidence of borers or other insect damage should be rejected.

4. Check individual plants for proper habit of growth as follows:

- A. If a particular habit, i.e., single stem, multiple stem, etc., has been specified, be sure to obtain plants that conform to this requirement.
- B. If no particular growth habit has been specified, then the current *Arizona Nursery Association Grower's Committee Recommended Tree Specifications* as published by the AAN should be used as a guide.

- C. Shade and flowering trees should have top growth symmetrically balanced. Shade trees should have a single leader. The balancing should be well developed and characteristic of the species.
 - D. Evergreen trees should be full foliage plants with uniform density. Sheared plants, such as pines sheared for Christmas trees, should be avoided unless specified.
 - E. Shrubs should be well branched in a manner characteristic of the species. The current *American Standard for Nursery Stock Z60.1*, is an excellent guide for determining the proper number of branches for certain size shrubs.
5. Check all container grown plants to determine that they meet the requirements outlined in 1 through 4, above. In addition, a random sampling of plants should be removed from their containers to determine that the root system is healthy. Plants that are found to be pot bound and plants that have insufficiently developed root systems to hold the soil together when removed from the container should be rejected. Healthy roots should be able to hold the soil mass together yet not be crowded around the outside perimeter of the container.
6. Planting stock that is based on the above criteria may be tagged with seals placed on all plants or representative samples at the nursery. This will assist in future inspection of these plants when delivered on the job site. Seals placed on planting stock for later identification do not imply acceptance on the construction site.

806-3 Construction Requirements

806-3.02 Excavation

The layout of landscape features should clearly show where exact dimensions are required and where some variances will be permitted. Accurate location of all buildings, roads, walks, paved areas, and features such as sculptures, walls, pools, etc., must be accomplished. Landscape beds, trees, and indigenous features must be laid out to mold the landscape architect's patterns to the existing topography and available area. Some variances are generally allowed in the bed area and tree locations of the proposed plan to fit the particular situation; however, coordination with the various other plans and with the landscape architect is advised.

Trees must be adjusted for minimum clearance to roadways and allowances must be made for mowing (especially when the tree is fully grown). One must ensure that placement of trees is not over existing utilities or drains or those tall growing trees are not placed under overhead utility lines. Shrubs and ground cover beds are often intended for unmowable areas. The outline must be adjusted to fulfill the intent and the edge should create a "flowing" outline that is aesthetically pleasing and mowable. It is important that sufficient stakes are used to clearly outline the planting areas.

The Inspector should check and approve the stakeout of all planting areas and planting hole locations prior to excavation. Minor relocation of planting areas and holes can be done at this time to avoid utility lines, rock outcrops, drainage ditches, or impervious or wet soil conditions. If minor relocation of plantings are not possible, the Inspector should contact the Landscape Architect to adjust the design requirements.

The Inspector should observe excavation of planting pits to determine if they will drain (not hold water). Test pit drainage in accordance with the specifications if the Contractor has a difficult time excavating, or the ground looks impervious.

806-3.03 Shipping and Handling Plants

Inspection of stock at the construction site is to ensure that the plants are from an approved source, are in a healthy and undamaged condition, and conform to sizes, quantities, and standards called for in the specifications.

This inspection should consider the condition of the plant and the use of proper handling procedures prior to delivery at the construction site. Inspection at the construction site should include the following checks:

- Each shipment of plants should be free of weeds, disease and insect pests, and meet all applicable State and Federal certification requirements. All necessary quarantine or State nursery inspection certificates should accompany each shipment.
- A representative sample of all plants should be legibly tagged with the correct botanical name, common name, and size to agree with the specifications and plant list. Bare root plants should be shipped in bundles with each bundle properly tagged.
- Planting stock which has not been inspected at the source should be inspected as appropriate, in accordance with items 1 through 6, "Inspection at the Nursery". This should be done as the material is being unloaded, or immediately thereafter, so that plants which are unacceptable can be set aside for removal from the project site.
- Where root formation is irregular, measurement of the spread of bare root plants should be the average, considering all sides of the plant, rather than the maximum root spread. The Inspector may allow moderate deviations from exact measurements in the case of plants that normally have irregular root systems.
- Large root stubs on nursery grown balled or bare root stock should be considered evidence of lack of proper care and root pruning, and sufficient grounds for rejection of such plants. Root stubs frequently characterize "collected" stock and precautions should be taken to ensure that root systems are adequate.
- Damage to plant material caused by improper operation of mechanical diggers may be sufficient cause for rejection at the construction site. Plants dug with equipment leaving a cone shaped ball should be carefully checked to make sure that an excessive portion of the feeder roots have not been cut away.
- Bare-rooted plants should have adequate live, damp, fibrous roots, free of rot and mold. Earth balls should be unbroken and of specified size.
- Precautions should be taken to prevent the drying of root systems in all shipments of plants to ensure arrival in good condition. During transport, plants must have been protected by a covering such as canvas or plastic sheeting. Bare root plants should have been protected by moist burlap, sawdust, plastic, etc. Under no conditions should the root system have been allowed to dry out. All plants must exhibit normal thrift and vigor.
- Plants damaged in transit, or not conforming to the specifications, should be rejected. All rejected plants should be removed from the site immediately. However, these plants may be suitable for other jobs so take care and do not damage any rejected plants. Be careful that any system of identifying these plants does not ruin them for resale to other buyers.

Following completion of inspection, all plants accepted should be carefully stored and maintained until planted.

All plants not planted on the day of arrival at the site should be placed "in storage", and handled as follows:

- Outside storage should be shaded and protected from the wind.

- Bare root or balled plants stored on the project should be heeled-in to protect them from drying out at all times by covering the bare root or balls with moist sawdust, wood chips, shredded bark, peat moss, or other approved mulching material. Plants, including those in containers, should be kept in a moist condition until planted.

806-3.04 Planting

(A) General

The Inspector should determine that planting operations at the construction site are properly completed in conformance with Contract Plans and Specifications and good horticultural practices. The planting operation does not usually begin until the irrigation system has been completed, tested and fully operational to supply water to plants.

The Inspector and Contractor should jointly review and become familiar with all plan sheets, quantities, details, specifications, and other provisions of the contract. At this time, questions or interpretations can be answered or problems resolved through discussion with the landscape architect, horticulturist, or other authorized persons.

All materials that have specification requirements shall have an approval of source prior to incorporation or use on the project. Additionally, samples of these materials will be required to verify adherence to the specifications.

Prior to installation of plant materials, the following preparations should be completed according to the requirements of the Plans and Specifications:

- Plantings should be performed only during the specified planting season.
- If the soil is dry, irrigate the planting bed as specified before planting.
- Check for correct depth of the root collar, which is at grade.
- Bare root plants should have roots spread out carefully before planting.
- Ball and burlap plants should have twine removed and burlap removed or rolled back and buried below grade.
- Place approved backfill material around plant roots or plant balls, being careful not to damage the ball or the fine root system of bare rooted plants. Backfill that is frozen or wet should not be used.
- Eliminate air pockets in the backfill by filling, tamping, and watering as required by the specifications. It is generally advisable to water the plants thoroughly before the backfilling of the pit is completed. Container plants should be moist at the time of planting.
- When the above operations have been completed, if specified, a berm of soil should be placed around the perimeter of the pit to form a basin or saucer to facilitate watering and retention of rain or irrigation water.
- Biodegradable pots should have sides scored and top edge broken down below finish grade.
- Container grown plants shall have metal or plastic containers removed carefully prior to planting. Metal containers shall be cut at least twice with a sharp "can cutter" before removal. Plants that have root balls that fall apart shall be rejected.
- Weed control around planting holes or entire bed area as called for by the Contract Specifications. The Inspector should check to be sure that weed root systems have been killed. The interior color of dead or dying roots is usually tan or brown, whereas healthy roots are usually white. If the root systems are alive, planting should be delayed until they can be killed. Perennial weeds with extensive root systems such as Canada thistle, Horsetail, Wild pea, Field bindweed, or Bermuda grass (see *Common Weeds of the United States--United States Department of Agriculture*) should not be controlled by hand weeding; they should be controlled with herbicides by a licensed applicator. Details of the application

should be documented on the [Herbicide and Pesticide Application Log](#) and the Inspector should reference their observation in their Daily Diary.

- Excavation of planting holes, pockets, or beds to the required size and depth and spaced as shown on plans.
- Extra work may be required to deepen any planting pit that does not drain properly. Payment will be made under a Force Account Item.
- Preparation and stockpiling of backfill mixture as called for by Contract Specifications.
- The planting holes are to be excavated minimally to the sizes on the contract plans. In mixed planting areas, trees are usually planted first followed by the larger shrubs, low shrubs and finally planted with ground cover plants. The holes for trees and large shrubs may be dug well ahead of time, provided that the holes are backfilled with an approved soil or soil mix within a day or two after digging. The [Soil Amendment Inspection](#) form should be completed by the Inspector and referenced in their Daily Diary. Before backfilling especially in drilled holes, the sides and bottoms must be scratched and loosened to break all "glazing". This promotes moisture transfer between different soils (existing and backfill). Holes that are staked in solid rock or other impervious material shall be moved or omitted.

(B) Nursery Stock

Planting pits must be prewetted before planting nursery stock. Two to four days before planting the pits must be irrigated for at least twelve hours. Care must be taken to avoid damaging plants during movement from the storage area to the planting site.

Plants should be protected against drying and handled carefully to avoid cracking or breaking the earth ball. Bare root plants should be "puddled" when removed from the heeling in bed to protect the roots from drying. Plants should be protected against freezing or drying by a covering of burlap, tarpaulin, or mulching material during transportation from the heeling in bed to the planting site. Should damage occur, or be found at this time, the plants should be rejected and removed from the site.

In order to ensure against reuse of discarded plants, seals should be removed at the trunk or stems above the root crowns and marked with a small spot of paint or dye. Since discarded plants are the property of the Contractor, they should not be marked or mistreated in such a way as to make them unfit for other uses.

806-3.05 Pruning and Staking

All plants should be staked and pruned, as specified, in accordance with accepted horticultural practice.

- Stakes should be driven solidly into the ground and guying installed to prevent excessive movement of the plant until the root system is firmly established in the new planting location.
- Deciduous plants should be pruned at planting time to restore a balance between the root and top growth. Tops should be pruned to compensate for the partial loss of roots when the plant was removed from the nursery, in a manner that will retain the characteristic shape of the plant. The larger pruning wounds and those made with a pruning saw should be finished smoothly with a pruning knife and dressed with pruning paint (see *Sunset Garden Book--Pruning Techniques*).
- Generally, all deciduous trees should be pruned by removing 1/3 to 1/2 of their former branch structure. Broken or damaged branches, plus competing leaders, should be removed.
- Trees may be pruned before planting to save time and trouble. At this time, hand clippers can be used to cut closer than can be done with pole pruners; usually used for trees in an upright position. Pruning may be done under Inspector's supervision prior to planting.
- All broken, torn, or damaged roots should be pruned, leaving a clean cut surface to help prevent rot and disease.

- Deciduous shrubs should be pruned to approximately 1/2 their former branch structure.
- Coniferous and broadleaf evergreens normally should not be pruned except for broken, crossed or forked branches, unless otherwise specified or directed.
- Broadleaf evergreen trees should have 1/2 of the length of long branches pruned to help prevent future wind damage. No entire length of any branch should be removed unless directed by the Landscape Architect.

Watering all plants as needed completes the planting operation. Weather and soil conditions dictate the need for watering. Over-watering is as harmful as under-watering. Adequate watering is more critical during the first few weeks following transplanting. Do not allow plants to stress from lack of water.

806-5 Basis of Payment

Payment for trees, shrubs and ground cover plants is to be made as specified in the contract. Upon completion of the planting operation, the Inspector verifies the quantity of plants and the Contractor is paid on that monthly estimate based on the Inspectors count. The Contractor warrants any failures of plant materials during the Plant Establishment Period and replacement will occur at that time.