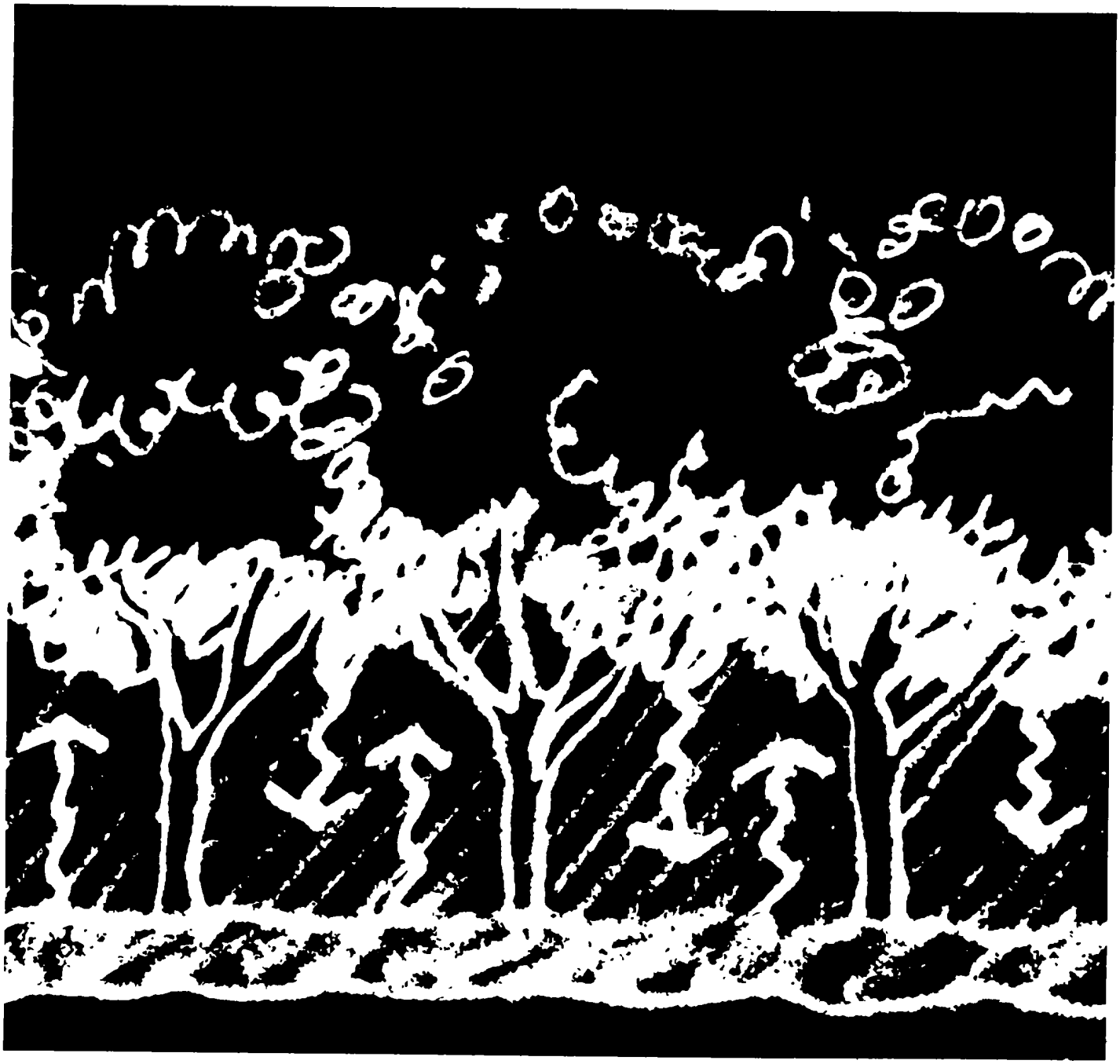
Most military installations contain generous areas of indigenous natural vegetation They have provided not only a pleasant setting and visual asset but also have served to minimize the environmental impact of development while also modifying climatic extremes in most older installations, past planting programs for streets, installation boundaries, open space and buildings have reached maturity and provide a character unmatched in more recent development (*figs 6-1 and 6-2*)



Section I:

Observations and Objectives.

6-1.
Typical Problems.

A. Budgets.
Budgets for plant materials have often been eliminated or reduced in recent developments creating stark, sparsely planted facility settings *(fig. 6-3).*

B. Functional Uses.
Planting design is sometimes misconceived as a means of providing only decoration or ornamentation, while ignoring the many functional uses.

C. Maintenance.
The planting design and selection of plant materials has too often ignored future maintenance costs.

6-2.
Objectives.
The overall objectives of planting are to improve the physical and psychological well-being of people who live and work on military installations. The specific objectives of planting can be stated as:

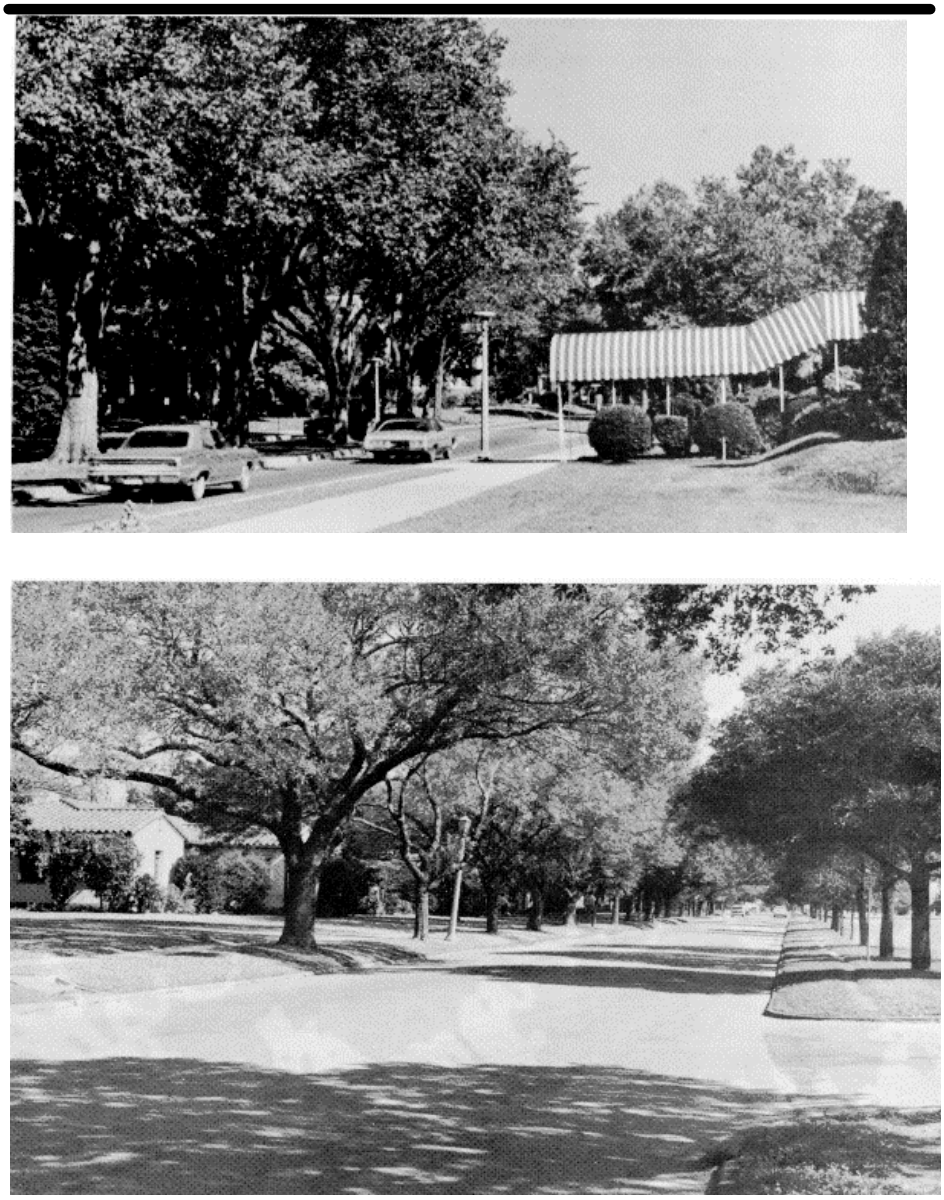


Fig. 6-2.

A. Preserve and Enhance Existing Landscape Resources.
Existing trees, forest lands and detail planting features are important resources and visual assets that should be carefully preserved and enhanced for functional as well as aesthetic uses.

B. Improve the Overall Visual Quality.
Aesthetic and functional applications of appropriate plant materials should be properly recognized and employed to help improve the landscape character

of military installations. This objective includes: harmoniously blending the built with the natural environment; providing scale and comfort to pedestrian environments; visually reinforcing the hierarchy of the road network; screening unsightly views or elements; and buffering incompatible land uses.

C. Improve the Environmental Quality of the Installation.

Better use should be made of plant materials for environmental quality and energy conservation. Plants can be effectively used in a variety of environmental applications including soil erosion control, air purification, noise abatement and climate modification.

Fig. 6-3.

D. Minimize Maintenance Requirements.

Appropriate plant selection and detailing can minimize maintenance requirements while improving the visual quality of an installation.

Section II:

Design Guidelines.

6-3.
Process.

A design process that includes conscientious site analysis, site design, plant selection and site detailing should be employed to achieve the desired objectives of a planting program.

A. Site Analysis.

A complete site survey and analysis of existing conditions must be undertaken, including an inventory of both natural and built environments. Site factors of fundamental concern relative to both the retention of existing, as well as the installation of new, plant materials include:

1. Visual factors
2. Climatic data
3. Existing vegetation
4. Soils
5. Hydrology
6. Topography/slope analysis
7. Spatial analysis
8. Program analysis
9. Circulation patterns
10. Noise factors
11. Security requirements
12. Maintenance requirements

B. Programming.

Before a planting design is begun, development of a program is necessary. A description of user requirements and environmental design objectives constitutes the program User needs, environmental problems and maintenance capabilities should be carefully and thoroughly studied. In general, facilities in the 300, 500, 600 and 700 classes, as described in AR 415-28, NAVFAC P-72 and AFM 300-4, Vol. 4, require some planting. The extent of the planting will vary with each class and with each category of facility within the class. The function and prominence of the facility should be the guiding factor in determining the scope of planting.

C. Conceptual Design.

After site analysis and program data have been evaluated, a conceptual design can begin. This involves arranging plant material masses on the site to satisfy the needs and requirements established by the site analysis and program. Plant masses should be arranged in terms of their intended use relative to their forms and sizes, as opposed to specific species and varieties. The primary concern of the conceptual planting design phase is to provide solutions to the functional requirements of the site, upon which preliminary costing and phasing can be developed.

D. Specification of Plant Materials.

After a satisfactory conceptual design is developed and adequate funding is assured, a final planting plan should be prepared. This involves translating the desired forms and sizes of plant masses determined at the conceptual phase into specific species and varieties of plant materials. To successfully make this translation, a thorough knowledge of available plant materials and their functional characteristics is required.

6-4.
Principles.
A. Unity.
Unity is the most important requirement of a good planting design.
1. One means of producing unity in planting design is to enclose an open space or frame a vista. Open areas may be unified into attractive landscape features for a variety of uses such as athletic fields and parade grounds. Where a view beyond the open area reveals objectionable features in the winter, a screen composed primarily of evergreen material may be used. Where the view beyond is pleasant, deciduous trees and shrubs may predominantly be used in the landscape screen.
2. In an area of buildings otherwise characterized by mundane or incompatible architecture, the colors and textures of mature trees and shrubs tend to lessen the contrast between buildings, and visually unify the total composition of the area *(fig. 6-4).*

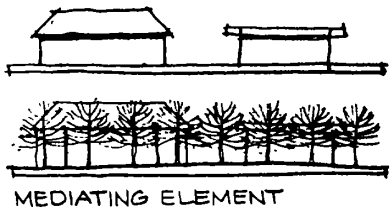


Fig. 6-4.

3. A plant or plant mass can be either a focal object that provides visual delight or a support element that helps to reinforce or frame a focal element such as a view, a piece of sculpture or a building *(fig. 6-5).*

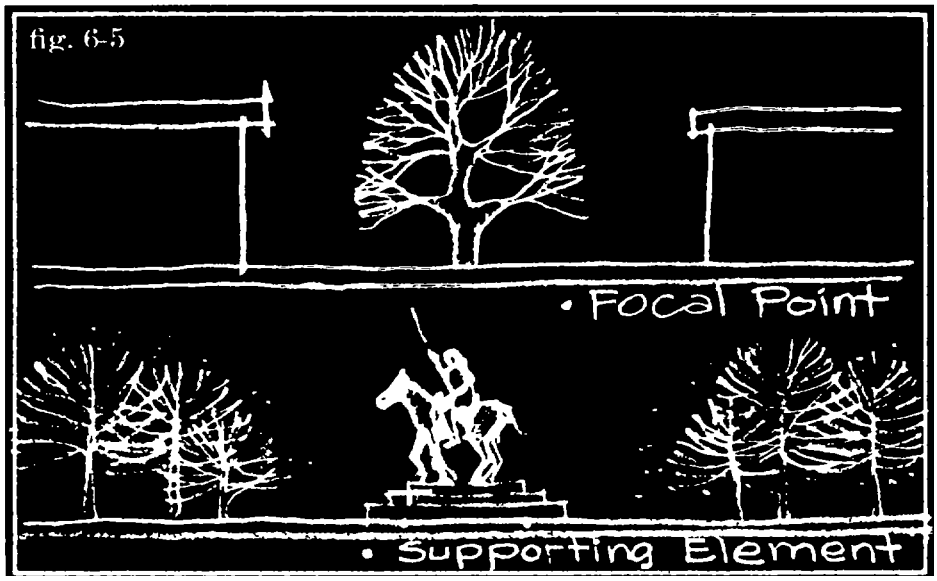
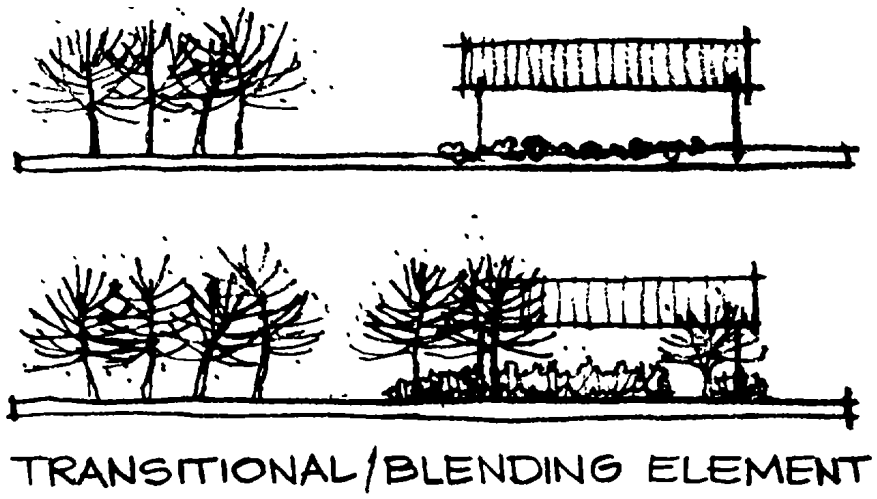


Fig. 6-5.

4. Plants can play two roles in relating a building to its setting. At a detail level, plants can visually integrate a building with its site where the outdoor ground plane meets the building mass *(fig. 6-6).* On a larger scale, plants can serve to naturally blend a building with its overall site setting.
B. Balance.
Balance is the arrangement of masses (plants or groups of plants) to achieve visual equilibrium by employing either a symmetrical or asymmetrical pattern.

Fig. 6-6.

1. Symmetrical or formal balance exists where the same number, size and type of plants are placed on each side of a visual dividing line such as a walkway. While informal or natural arrangement of plants is often desirable for overall appearance, the importance of certain areas, selected buildings or approaches to them can be emphasized by formal planting *(fig. 6-7).* Formality in planting requires high maintenance to retain a consistently satisfactory appearance. Plant losses are conspicuous, and difficult and costly to replace. Informal or naturalistic plantings soften the environment and, if losses occur, they are inconspicuous and may be replaced easily with small plants.



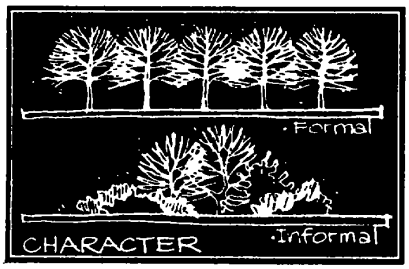


Fig. 6-7.

In planting along streets, excellent design results may be obtained by a combination of formal and informal planting of trees. Planting should be predominantly informal with only occasional use of symmetry to accent a particular architectural or site feature.

2. Asymmetrical balance can be achieved by using different types of plants in a mass or group which appear to balance. A large shade tree may have a balancing effect when used with a group of smaller ornamental trees or shrubs. Asymmetrical balance is more difficult to create because seasonal changes and growth alter the appearance of plants. However, if the plants are carefully selected, asymmetrical balance throughout the year is possible. Some deciduous plants, for example, have branching patterns which balance with other plants in the composition even during the winter when foliage color has changed or disappeared.

C. Contrast.

Contrast is achieved by the arrangement of plants in relation to each other in such a way that differences in size, shape, texture or color are apparent.

Plants can be selected and arranged to focus attention on other plants, as in the case of an evergreen hedge serving as an effective background for flowering shrubs. A mass of low plants provides a good base for an entrance sign and in this way focuses attention on the sign. Similarly, large trees may be used to emphasize a building entrance *(fig. 6-8)* or a site feature, such as a gateway. In both cases the trees create a more human scaled environment and the contrast draws attention when seen from a distance or close-up.

Fig. 6-8.

D. Rhythm.

Rhythm is achieved by a regular spacing of single plants or of plant masses, such as a row of trees or shrubs, or the

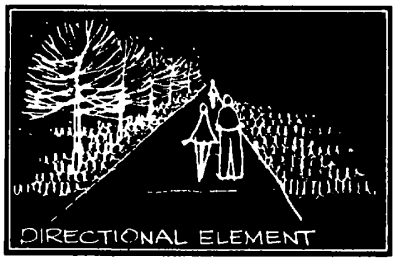


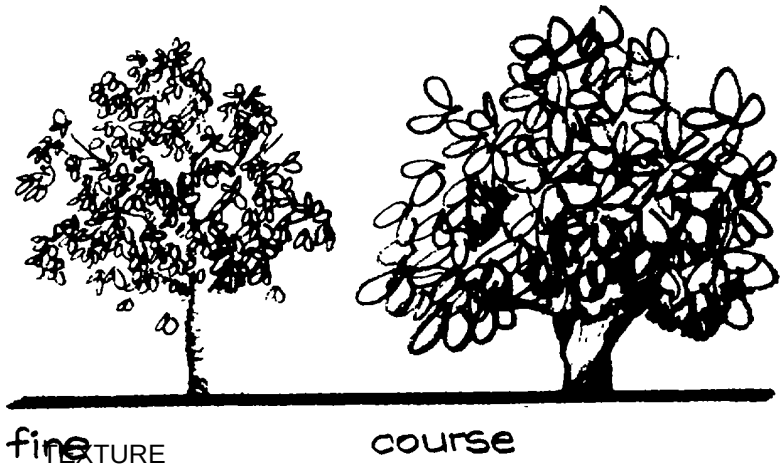
Fig. 6-9.

repetition of similar plant groupings *(fig. 6-9).* Rhythm produces emphasis and unity and is especially effective in articulating main routes of circulation by street tree planting. A more subtle form of rhythm on a large scale may be attained by variations in spacing and by repetition of such variations Rhythm in color, shape or size may also be used.

E. Color and Texture.

The color and texture of plants can improve the appearance of an area as well as serve a functional use. Since light, shade and observer location affect both color and texture, the amount of sunlight falling on colorful plants should be considered in their location. Plants having a distinctive texture will look differently depending upon whether they are seen with back or front lighting or from a distance or close-up. Plant surfaces may range from glossy to dull and this also affects their appearance.

1. Colors are classified in two basic emotional categories: warm colors (red, orange, yellow) which are stimulating, and cool colors (violet, blue, green) which are calming. Color can produce contrast, such as flowering shrubs with an evergreen background. Sharp contrasts should usually be avoided. Large masses of a single color of foliage or blossom are generally more satisfying than a heterogeneous mixture of several colors. "One of each kind" is a design style to avoid. Care should be exercised to pick colors which are harmonious when seen together. Many deciduous plant materials found in most parts of the country provide a variety of fall foliage coloration.



TEXTURE

Fig. 6-10.

Some evergreens such as holly produce good fall and winter color with their berries.

2. Texture in plant materials can be coarse or fine *(fig. 6-10).* A plant will have a different texture depending upon the distance from which it is viewed and its relationship to surrounding materials. A planting screen which is intended to serve as a security measure can be very effective if it is composed of rough, thorny plants.

F. Simplicity.

Layout plans should be broad and simple in form so that excessive maintenance will not be required. Shrub beds should be simple in shape when they are bordered by turf requiring mowing. Isolated geometrically shaped beds of shrubs or ground covers make mowing of turf costly and detract from an orderly appearance. Large power mowing equipment cannot operate efficiently in areas cluttered with isolated plantings. Hand trimming or the use of small mowers can be very costly in manpower. Lawn areas are simpler to mow if trees are planted in shrub beds or ground cover areas. Small hard-to-mow turf areas should be avoided by substituting ground covers or shrubs that require less maintenance.

G. Ultimate Effect.

Planting should be as permanent as possible. In the choice of plants and their arrangement, the ultimate effect must be kept constantly in mind. The overall plan should indicate the plants at approximately two thirds (2/3) of their ultimate size which will assist in providing the correct spacing. Short-lived plants which grow quickly should be used only where an immediate effect is essential or where, in the course of time, they may be removed as the space they occupy is filled by growth of the more permanent plants. Tall growing plants should usually not be planted under windows. For example, evergreens, which are forest trees in their native habitat, would either cut off light, air, and views from the windows or they would have to be sheared at frequent intervals. Planting in the vicinity of traffic intersections must be of a low-growing or high-branching variety so as not to block vision from passing vehicles. It is better to choose trees and shrubs in smaller sizes and wait somewhat longer for the desired effects than it is to compromise by substituting inappropriate species. However, the use of a few large trees as accents will help create an early effect of permanence.

H. Spatial Articulation.

Plants can be used to create enclosed spaces and to separate spaces one from another *(fig. 6-11).* They can also be used to direct people through outdoor spaces by visually defining and reinforcing patterns of movement *(fig. 6-12).* The degree of enclosure, separation, or movement depends to a large extent upon the density, form and type of plants used. Deciduous plants vary with the season, whereas evergreens do not.

Fig. 6-11.

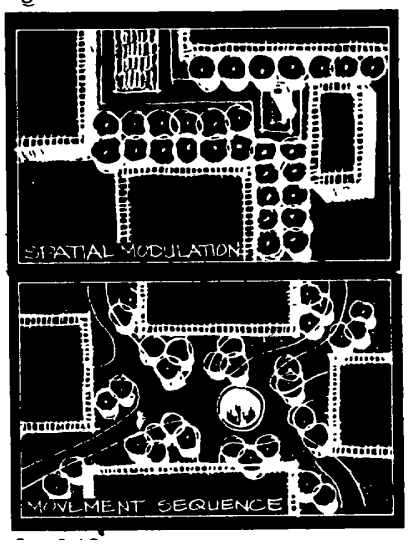


Fig. 6-12.

1. Screen planting, implying that something is to be concealed from view, is achieved by the use of plants with dense, abundant foliage. Planting requires more room than a fence or wall to be effective for screening purposes, and requires more maintenance. Thus, where area limitations prohibit use of plants, a fence or wall softened in appearance with vines or a few shrubs may be a more effective and economical solution.

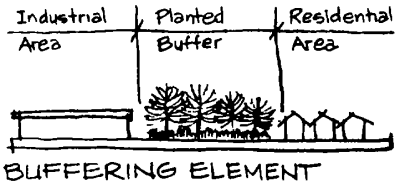


Fig. 6-13.

2. Plant materials to be used as buffers may be comprised of lawn areas; shade trees planted in groups; and combinations of shade trees, flowering trees and broad-leafed evergreen shrubs *(fig. 6-13).*

3. The use of street trees is one of the most effective means to visually soften, complement and define the road hierarchy. Trees provide shade and improve the overall visual quality of the installation. A systematic design approach should be employed to establish a coordinated street tree planting plan for the entire installation.

6-5.
Attributes.

A. Aesthetic Values.

Plantings made for utilitarian purposes, such as screening service areas or shading hot pavements, will simultaneously improve the attractiveness and enhance the livability of an area. Variety is introduced, vistas may be created and bareness relieved. A desirable effect of planting is to cause apparent reduction in the scale of structures. The oppressive feeling of monumental scale is relieved by proper planting. Building groups may be separated visually into several pleasant framed units, and individual buildings within a group may be enhanced. The use of shrubs and small trees arranged in strategic groups around a building often improves the appearance by softening structural lines. This also helps in integrating the building with its site and diverting attention from unattractive structural features. Vines on large, blank masonry walls can be pleasant but should not be used where injury to the structure may result.

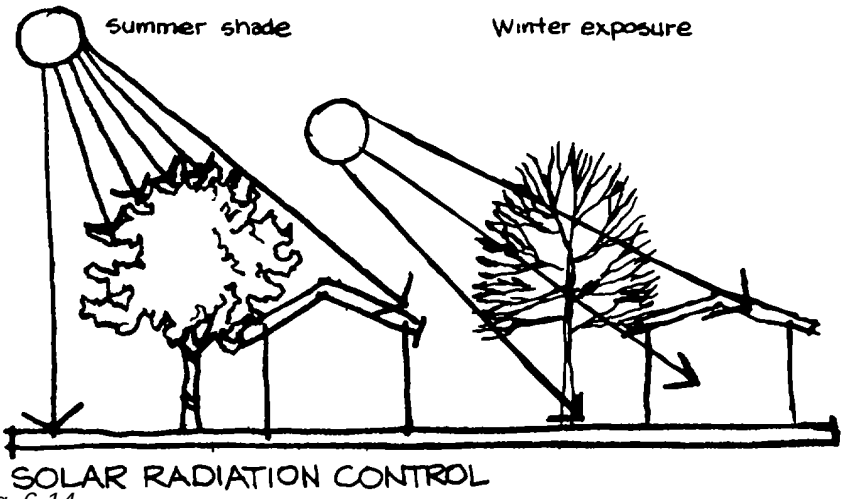


Fig. 6-14.

B. Wildlife Conservation.

Plant materials are supportive of wildlife and encourage the number and variety of animal species.

C. Environmental Controls.

1. Energy Conservation.

Skillful utilization of plants can significantly increase the energy efficiency of buildings. Air conditioning requirements for most buildings result from solar energy absorbed by building surfaces. By simply shading those portions of the building receiving the most sun, cooling requirements can be significantly reduced *(fig. 6-14).* During summer months, trees can provide shade and thus reduce cooling requirements; during winter months, the bare branches of deciduous trees allow sunlight to reach exterior surfaces and thus help heat the building. *(See Paragraph 3-4: Adapt Buildings to Natural Site Conditions,* for a thorough discussion of climatic design considerations.)

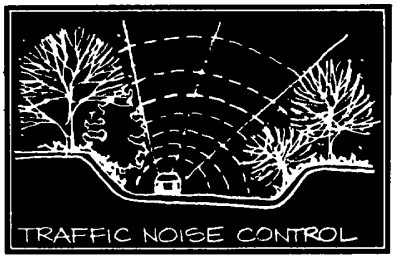


Fig. 6-15.

2. Reduction of Noise.

Dense foliage is of some use in absorbing and deadening noise *(fig. 6-15).* In such locations as open spaces between family housing areas and main traffic

arteries, deep belts of planting may prove beneficial in reducing traffic noise. Sounds caused by breezes rustling through the leaves and branches can also mask undesirable noise.

3. Wind Control. Wind is a climatic factor that can be either pleasant or unpleasant depending upon air temperatures, relative humidity and air velocities. Plants can be used as a wind control device by breaking, guiding, deflecting or filtering the wind *(fig. 6-16).* To properly design for wind control using plant materials a basic

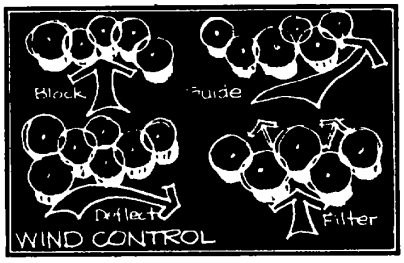


Fig. 6-16.

knowledge of air dynamics is necessary. Information about the directions of prevailing winds and their average speeds for different seasons of the year is, also necessary.

a. When plants are used as a wind barrier, wind can generally be affected for a distance of 2 to 5 times the height of the barrier to the windward side and 10 to 15 times the height of the barrier to the leeward side *(fig. 6-17).*

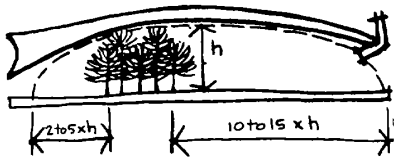


Fig. 6-17.

b. Plants tend to be better screens than fences or walls for windbreaks because they permit some degree of wind penetration. The distance of wind control on the leeward side is increased because less turbulence is created. The most effective density is a screen of about 60% *(fig. 6-18).*

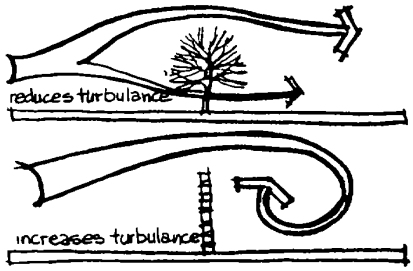


Fig. 6-18.

c. The depth of a shelter belt, or wind screen, has no real effect on the amount of wind protection provided; the primary factors providing effectiveness are the height and density of the plants *(fig. 6-19).*

d. Irregular forms tend to provide a more effective windbreak than evenly spaced plants. A variety of plant species and sizes also provides a better windbreak than one made up of one species *(fig. 6-20).*

e. Evergreen plants that branch to the ground are the most effective windbreaks year around. Deciduous trees and shrubs are effective only in the summer *(fig. 6-21).*

f. Wind velocities will be increased if permitted to penetrate under a high canopied tree. A gap in a windbreak will also tend to create stronger winds by funneling the air through the gap *(fig. 6-22).*

g. Snow drifting may be controlled by a series of plant barriers which increase and decrease wind velocities. This can be accomplished by sweeping an area of snow with strong winds and depositing it where wind velocity decreases *(fig. 6-23).*

4. Temperature Modification. Vegetation reduces the ambient air temperature by the cooling effect of transpiration (evaporation) of water through the leaves and also by shading the ground. Natural vegetation covering the ground tends to stabilize temperature, decreasing extremes, whereas paved surfaces usually tend to increase temperatures. Shade trees are important for comfort practically everywhere in the United States. In all areas except genuinely subtropical and tropical areas,

Fig. 6-21.

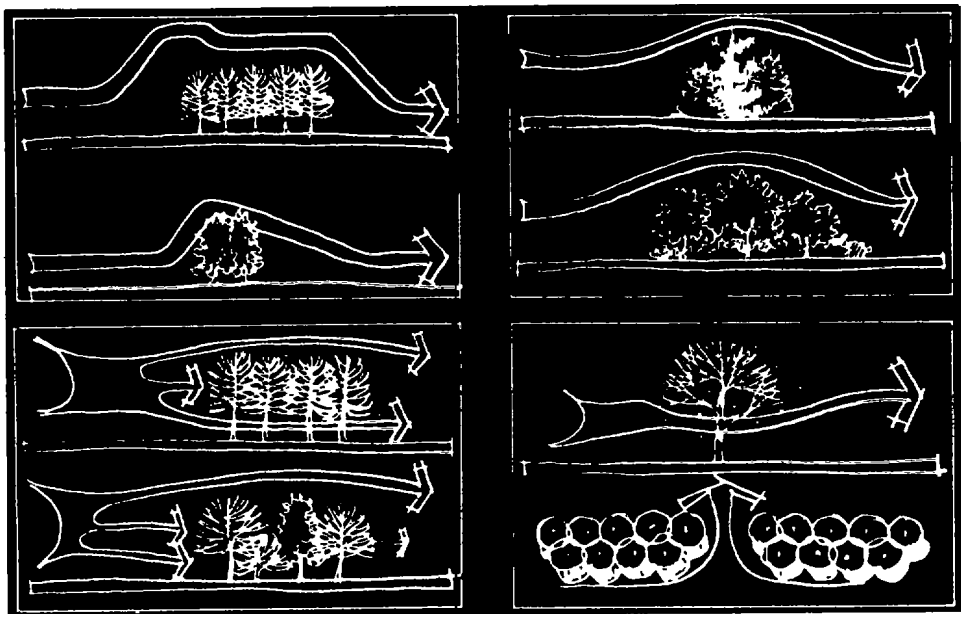
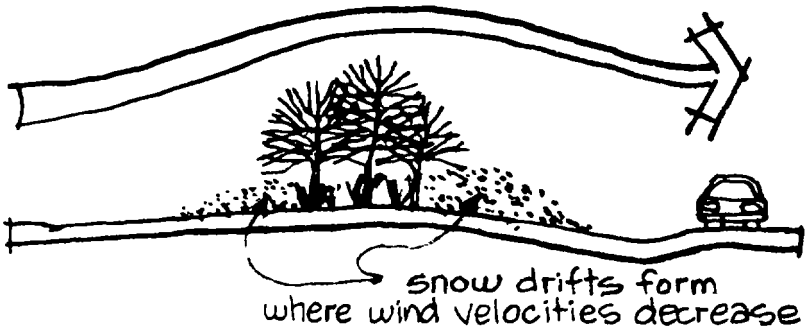


Fig 6-20.

Fig 6-22.



SNOW DRIFT CONTROL

Fig. 6-23.

trees are best for this purpose since they furnish shade only during the summer and permit sun to come through in winter. Shade in parking areas is desirable through the use of large growing trees spaced about 40 to 50 feet apart. However, certain kinds of trees exude gummy substances or attract insects and should be avoided.

5. Glare and Reflection Reduction. Glare and reflection resulting from man-made materials found in the environment cause visual discomfort. Plants can effectively soften glare and reflection while adding to the aesthetic quality of an area. The degree of effectiveness with which plants can do this depends upon their height, density and location *(fig. 6-24).*

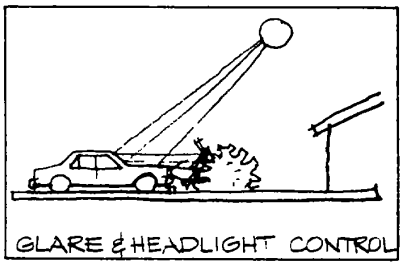


Fig. 6-24.

6. Erosion and Dust Control.

a. Water is the most significant eroding agent of soil. The two basic types of water erosion are caused by splash and runoff. Splash erosion is best controlled by ground covers and deciduous plants when in leaf. Runoff or sheet erosion is best controlled by grasses and plants with very fibrous root systems *(fig. 6-25).*

b. Plants can help to control dust by creating a barrier or by stabilizing soil which is bare of vegetation. Twiggy, dense branching plants are effective as wind barriers. Ground covers, grasses and plants with fibrous root systems are most effective as soil stabilizers *(fig 6-26) (See TM 5-830-2/AFM 88-17, Chapter 2 and TM5-830-3/AFM88-17, Chapter3, for specific guidance on planting turf and dust control.)*

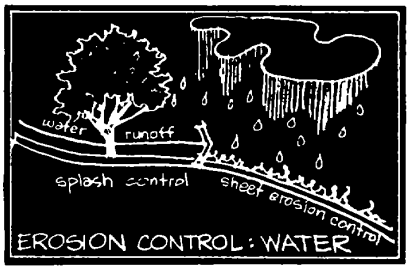


Fig. 6-26.

6-6.
Design Considerations.

A. Preservation.

For the general enhancement of developed areas, as much of the existing vegetation should be saved as is reasonably possible.

1. With high cost of extensive planting operations to restore cleared areas, often the total cost of complete clearing cannot be justified. In every case, the cost of replacing existing vegetation should be weighed against the cost of any special measures which must be taken for preservation, but the best decision cannot be reached by balancing costs alone.

2. Also to be considered is the time required to re-establish

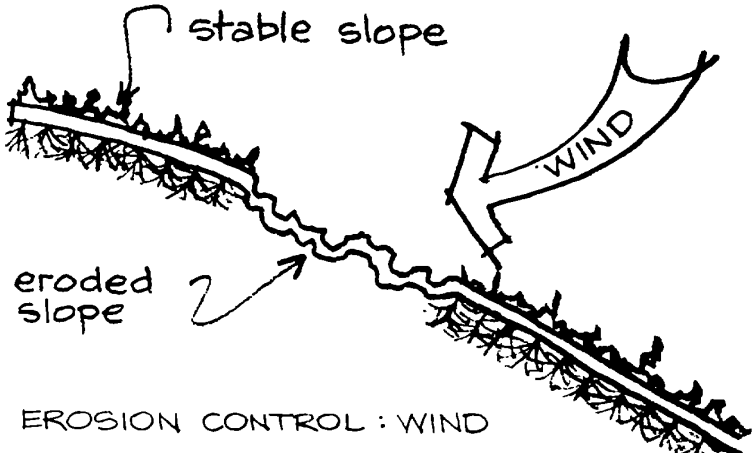


Fig. 6-25.

equivalent plant growth. This analysis may justify saving existing vegetation even if it proves to be more costly initially. Where immediate control of dust or erosion is of prime importance, such a conclusion may be easy to reach. The reduction of clearing and grading operations to a minimum contributes much to conservation and environmental protection, and lowers construction cost.

3. Fast-growing trees regarded as weed types may comprise the predominant native vegetation in certain areas. Such trees are sometimes worthy of preservation until new ornamental plantings have matured and the weed trees can be removed.

4. During site construction, minor variations in road and walk design layout should be made to avoid the destruction of or damage to important vegetation.

B. Maintenance.

Maintenance and its resultant costs may be kept to a minimum by coordinated planning. Design factors which are basic to economical grounds maintenance, and which should be considered in the early design stages of a project, are described below.

1. Drainage. Good drainage of surface and subsoil is necessary not only for the successful growth of nearly all plants but also as an erosion-control measure. Subsurface drains should be installed when necessary to correct conditions of excessive soil saturation. An alternate to subsurface drains, in some cases, is to select plant materials tolerant to wet conditions. Good surface runoff of planted areas will be assured by proper grading. *See TM 5830-4; NAVFAC P905; and AFM 88-17, Chapter 4.*

2. Grading. Steep slopes, if planted in grass or other vegetative cover, are difficult and expensive to mow and maintain and are subject to erosion Good grading design can often reduce the need for steep slopes. Grass slopes should not normally exceed a 3: 1 grade, with top and bottom rounded, to prevent erosion and facilitate mowing. Steeper slopes should be rip-rapped or planted with ground cover and/or other plants. Grading in the vicinity of existing trees to be retained should be avoided. Fill on and/or compaction of the soil within the foliage drip line will eventually kill the tree.

3. Detail Plating. Flower beds and sheared hedges require a great deal of costly maintenance and should be used sparingly in selected locations. Where flower beds and sheared hedges are appropriate, restraint in design is essential to their effectiveness and upkeep. Street trees should be located between the sidewalk and buildings, leaving the strip between the sidewalk and curb free for installing and servicing underground utilities.

C. Plant Selection.

Trees, shrubs, ground covers, vines and turf comprise the palette of elements in planting compositions *(fig. 6-27).* The varieties selected should be as few as possible to satisfy the requirements and objectives of the design. By limiting the varieties of plants, rather than cluttering the design with a planting mixture, clashing colors and forms are less likely to occur, and a unified composition will be created.

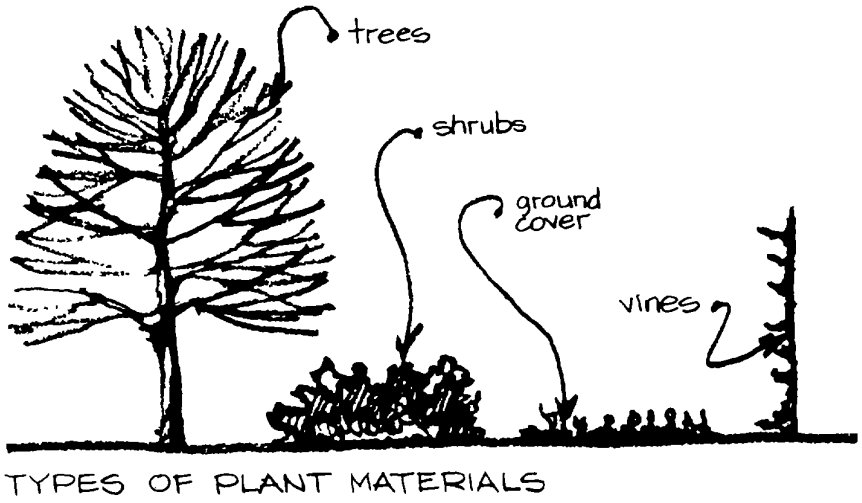


Fig. 6-27.

Repetition with occasional contrast contributes to a successful planting design. In selecting plants for a given project, it is helpful to remember their growth characteristics. These characteristics are documented in landscape architecture literature and are available through libraries and government publications, some of which are listed in *Appendix B.* Only those plants capable of thriving with low maintenance under actual site conditions and which are able to produce the desired effect should be chosen. A guide to the selection of plants that can be used with confidence may be gained by an investigation of plants growing at the project site and also at the oldest parks and cemeteries in the same general vicinity.

Species of plants, whether native or naturalized, found thriving under adverse conditions are likely to be successful with minimum maintenance. The ecological association of plants is an additional factor to be considered when selecting plants since, in nature, plants grow in groups requiring similar soil and climatic conditions. Other important factors in the selection of plants are hardiness to temperature extremes, requirements in terms of soil fertility, ability to survive in very wet or dry soil conditions, the degree of tolerance to wind or salt air, ability to be transplanted and resistance to insects and diseases. Recommendations on the choice of plants which are tolerant of specific site conditions can be obtained from the Agricultural Extension Service; Soil and Water Conservation District; or from Federal, State, County, and City park and forest agencies.

1. Trees and Shrubs. To assure maximum effectiveness with the lowest maintenance, emphasis should be placed on the use of trees instead of the extensive use of shrubs. Properly selected trees will ultimately be less expensive to maintain than shrubs and they are more effective for environmental control. Clean, simple but effective planting designs can be achieved with trees and lawns and the judicious use of shrubs.

2. Evergreen and Deciduous. Deciduous trees offer a wide variety of effects because of seasonal changes, flowers, berries, fruit, and color and texture of bark. Evergreen trees and shrubs are advantageous, if adaptable to the area, because they provide green color and contrasting background when deciduous plants are leafless. In southern states a wide variety of evergreen shrubs is readily available for use, but in more northerly areas the selection may be limited or costly. Where the latter is true, deciduous shrubs may be used for the greater part of the planting, introducing evergreen plants only at focal points in conjunction with important features and structures. In many areas of the country deciduous trees are very desirable since during cool months they permit a maximum amount of sunlight to penetrate.

3. Vines. The use and selection of vines must be very carefully done Many vines climb by means of tendrils and disks or root-like hold-fasts which can damage wood or masonry walls Maintenance and repair work can be difficult and costly if vines must first be removed Generally, vines should be restricted to arbors, trellises and structures other than buildings