United States Department of Agriculture

Soil Conservation Service

Midwest TSC
Federal Building, Room 393
Lincoln, NE 68501

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WINDBREAK TECHNICAL NOTE 1 - Landscape Resource Design for Windbreaks*

INTRODUCTION

The purpose of this technical note is to discuss landscape resource management as it applies to the design and installation of windbreaks and the modification of existing windbreaks.

SCS personnel are committed to providing high-quality comprehensive planning and design assistance for managing soil, water, and related plant and animal resources. The primary goal of the SCS conservation program is to install resource management systems that maintain or improve the resource base, achieve environmental quality, and improve the standard of living. Many conservation practices such as windbreaks, ponds, and critical area plantings improve both the landscape resource base and the environmental quality by their very nature. However, there are many opportunities to further improve the resource base and environmental quality in regard to landscape resources. The landscape resource involves the appearance of the landscape (visual resource), how prominent the visual resource is (visibility), and the benefits and uses the landscape provides (landscape use).

Landscape resource management should be considered throughout windbreak planning: During site inventory, evaluation, design, and implementation. In evaluating the potential and limitations of the site, consider such as soils, climate, and space. During the inventory phase, gather information to determine who will see the windbreak, how prominent it will be on the landscape, and its relationship to the visual character

*This technical note was prepared by Gary Wells, Landscape Architect, MTSC, and Dave Hintz, National Windbreak Forester and is based primarily on landscape resource experience in the Midwest area; however, the information can be applied elsewhere. In some special cases additional landscape resource design will be required. Consult an SCS landscape architect for further assistance.

of the area. By identifying visual character of the area--its patterns of landform, vegetation, water, and structures--design alternatives can be developed that maintain or improve the visual resource. When the site limitations and potentials are combined with the resource manager's objectives and the functional requirements of the practice, design alternatives can be developed.

DESIGN CONCEPTS

The three basic landscape resource concepts that apply to windbreaks are variety, visual compatibility, and multiple use.

1. VARIETY--The state or quality of having different forms or types. Visual variety is desirable. Landscapes rich in variety are likely to be more appealing than ones tending toward monotony.

2. VISUAL COMPATABILITY--The state or quality of orderly and harmonious visual elements. Alterations in the landscape character vary in their degree of contrast and can usually be designed to be visually acceptable.

3. MULTIPLE USE--The state or quality of being functional for multiple services. Landscapes that provide multiple use opportunities are usually more desirable.

Generally, in those areas that contain little visual variety, the objectives should be to increase variety. In areas rich in variety, the objectives should be to make the windbreak visually compatible with the surrounding area. For example, installing a windbreak on a visually uniform, intensively cropped landscape increases visual variety. In a recreation area where a variety of visual elements exists, a linear windbreak may not be desirable.

One way of determining whether alternatives are visually compatible is to compare the form, line, color, texture, and scale of the proposed practice with those of the existing visual elements.

The primary function of a windbreak is to provide wind protection. Windbreaks can also serve a variety of secondary functions, which should be considered in the design.

DESIGN CONSIDERATIONS

Alignment

Existing landforms, vegetation, use patterns, areas to be protected and wind direction should be considered when determining alignment.

Where site conditions allow, attempts should be made to curve windbreak rows to avoid an angular appearance. On land with contour farming or center pivot irrigation, curved rows are compatible with farming practices. (figure 1)

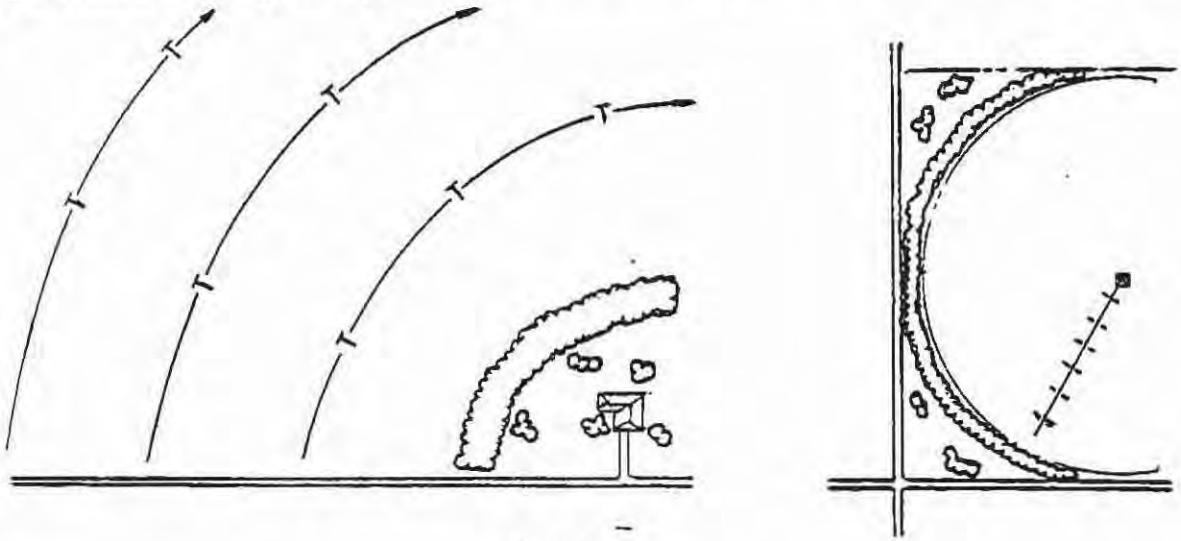


figure 1

A note of caution however; the distance between rows on curves may need to be widened to facilitate turning radius of cultivation equipment.

Edge Treatment

The linear appearance of windbreaks can also be reduced by establishing an irregular edge. The primary rows of the windbreak can be planted with a mechanical planter, and clump plantings made along the visible side of the windbreak to create an irregular edge. (figure 2)

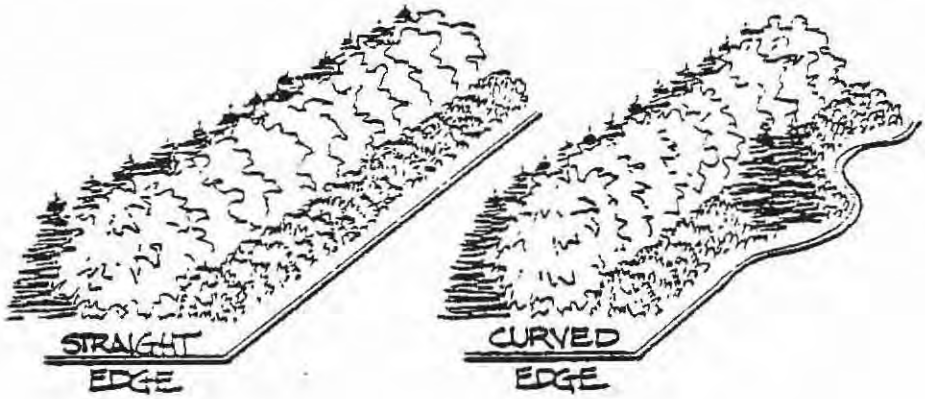


figure 2

Varying species in a leeward rows increases visual variety. (figure 3) Form, color, texture, and height of species are all elements of variety that should be considered. Using a variety of species within a row can also reduce potential impact of disease and insect damage.

Varying species in a row may also be necessary when soil types change significantly. (Consult forester for compatible species.)

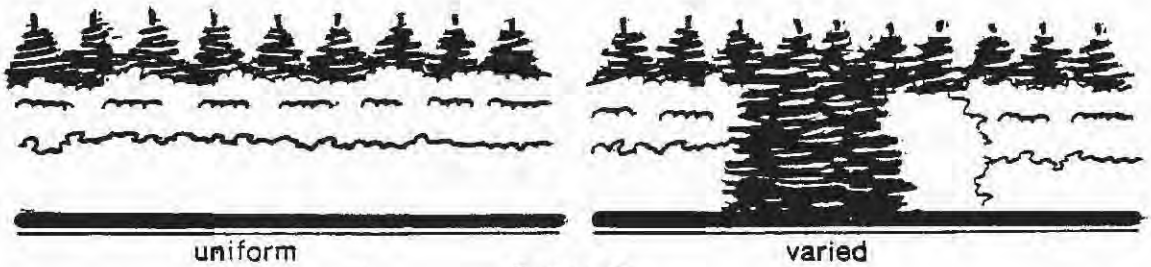


figure 3

SPECIES SELECTION

Windbreaks can provide many beneficial landscape uses. Their primary landscape use value is to provide wind protection. To increase the overall value of a windbreak, other functional uses should be considered when selecting species. Functional considerations include:

Climate Control Uses

Climate control uses of windbreaks not only include wind protection but windbreaks also reduce solar radiation and control snow drifting and dust. See Safety Section.

Visual Resource Uses

Visual resource uses of plant materials consider flowering, fruiting characteristics, form, color, texture, and height. Species with unique characteristics can be used as accent trees on visible sides of windbreaks (see edge treatment). A dogwood, for example, with its spring and fall colors, is highlighted if the main body of the windbreak is evergreen species.

In wooded areas, planting the same species already growing in the area helps maintain its visual character; for example, in a wooded park a windbreak should appear as an extension of the existing woods. (figure 4)

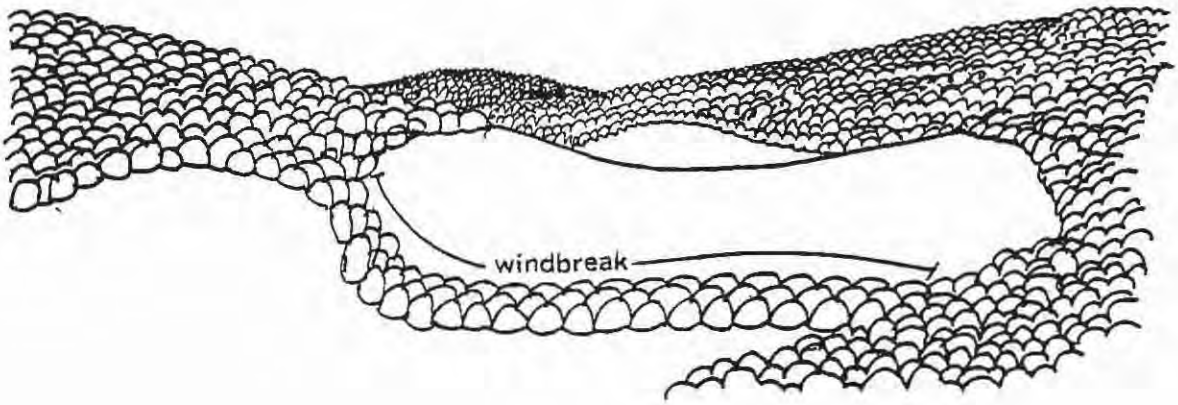


figure 4

Architectural Uses

Architectural uses include privacy control, space articulation, and screening undesirable views. (figure 5) When screening a view, plant materials should be planted close to the viewer.

In an urban area, a variety of species can be selected to create a theme or character to provide relief from the dominate manmade elements.

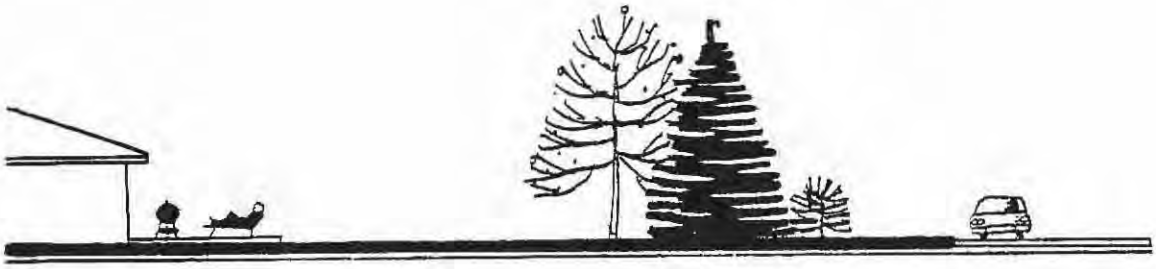


figure 5

Windbreaks can also be used to define spaces and even separate incompatible land uses or activities. (figure 6)

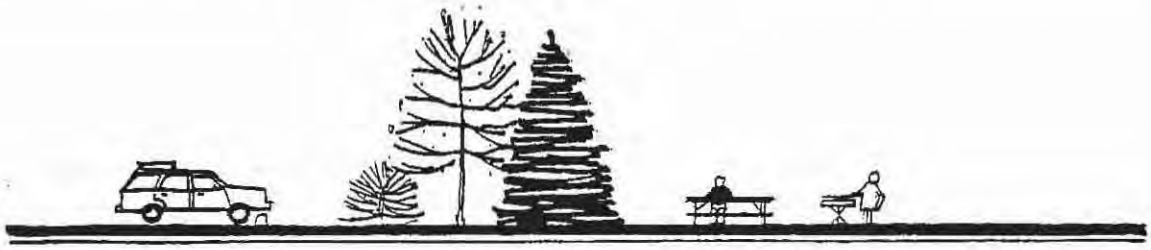


figure 6

Engineering Uses

Engineering uses include glare reduction, traffic control, noise abatement, and erosion control. Windbreaks near water or pavement can reduce glare. (figure 7)

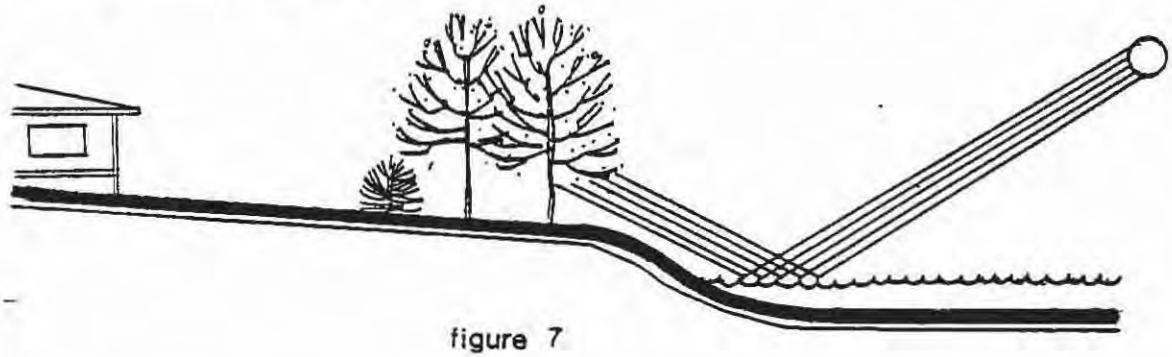


figure 7

Windbreaks can also control the vehicular and pedestrian traffic by the density of the planting.

If noise abatement is desired, windbreaks should be as dense as possible and planted near the source. (figure 8)

figure 8

Wildlife Uses

Plants provide food and cover for wildlife. The types of food and cover vary according to the wildlife species being considered. Windbreaks can be designed to maximize wildlife value by considering fruiting characteristics, density, and height of the plantings. The windward row is the key element in determining the location of the windbreak. The distance from the windward row to the primary area to be protected is determined by wind velocity factors and snowdrift potentials. Snow begins to accumulate from the windward row. This principle can be applied to increase the wildlife value of the windbreak. Conventional designs have blocks of trees several rows wide that fill with snow, reducing its value to wildlife. If the rows are split, an opening is created to catch the snow before it drifts the main windbreak body. This design has higher wildlife value by reducing snow cover within the planting and by creating more edge. (figure 9) Clump plantings also increse the amount of edge for wildlife. (See Edge Treatment.)

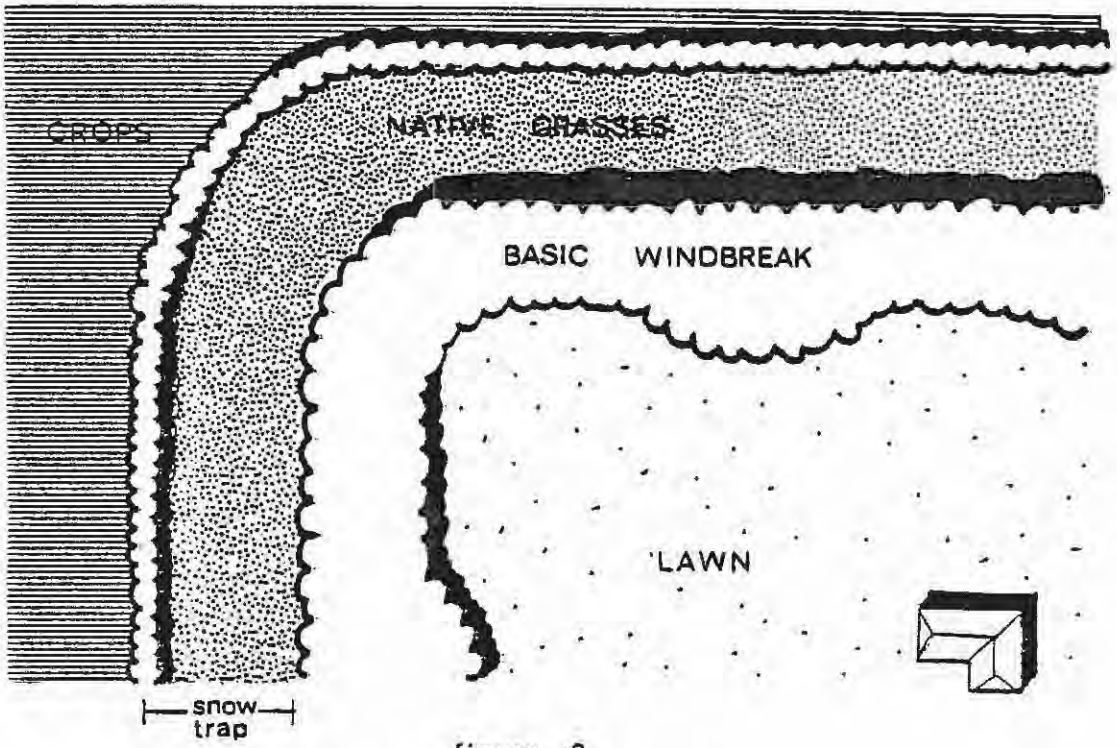


Figure 9

Economic Uses

Windbreaks can also be used for direct economic benefits. Species that provide fruit for human consumption can be incorporated into the windbreak design and harvested. Windbreaks can also increase property values.

SAFETY

Special consideration should be given to safety when designing windbreaks. Potentially hazardous situations are created when windbreaks are located near roads.

Snow Deposition

Windbreaks should be planned so that snow is not deposited on roads or driveways. A dense windbreak will deposit snow deeper and nearer to its base. A more penetratable windbreak drifts snow over larger areas and in some cases this approach is more desirable because moisture is provided over a greater area. (figure 10) In low rainfall areas, however, a dense windbreak will increase the moisture available to the trees. A dense windbreak is also more effective in trapping snow before it reaches roads.

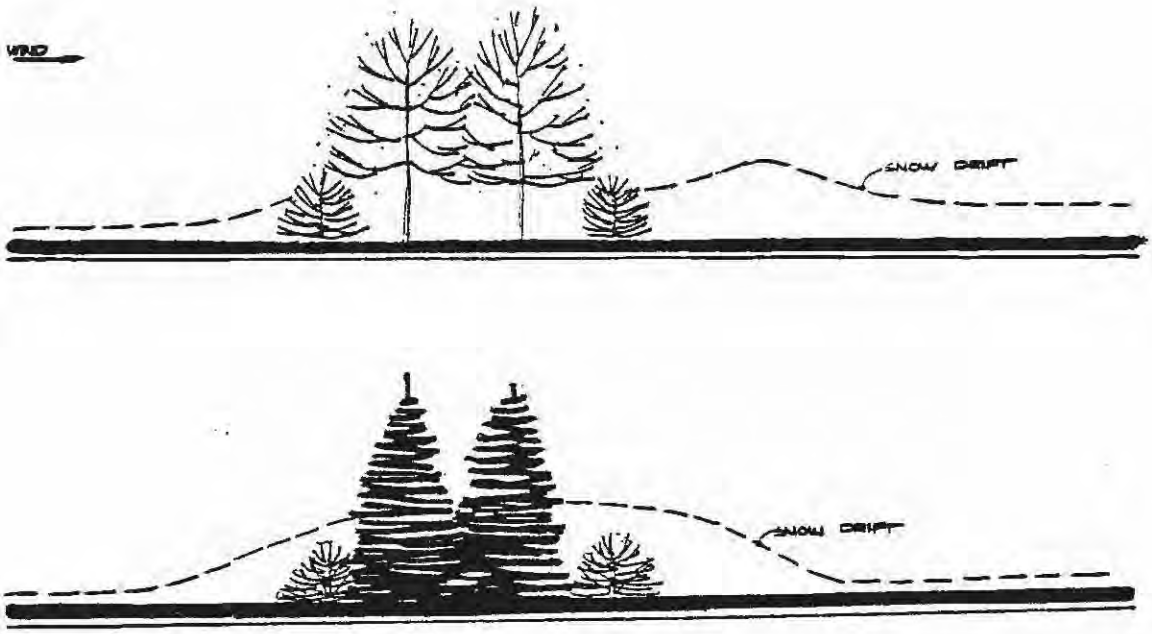


figure 10

Shading

In colder climates snow and ice are factors, consideration of the windbreak shadow pattern is important. When a windbreak is placed too close to a road, its shadow can delay the melting of ice on the pavement. The design height of species should be used to determine if the shadow pattern will create this potential safety problem. (figure 11)

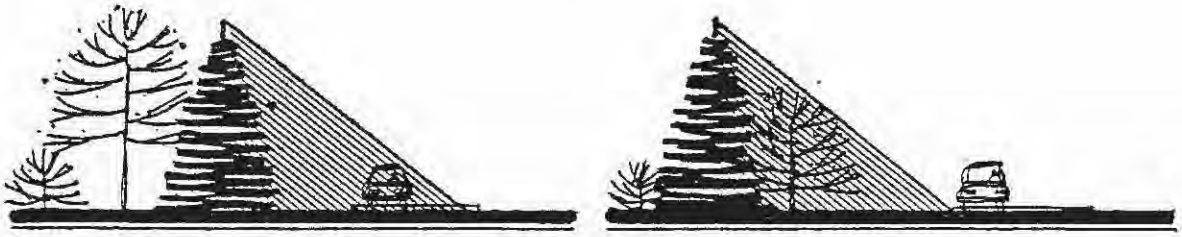


figure 11

The angle of the sun can be determined for the time of year and the latitude of the project area (see table 1). When the design height is combined with the angle of the sun, the shadow pattern can be determined for various times of the day.

Table I — Noon Solar Altitude

	latitude				
	30°N	35°N	40°N	45°N	50°N
DEC 22	38°	33°	27°	22°	17°
JAN 21	40°	36°	30°	25°	20°
FEB 23	50°	45°	40°	35°	30°
MAR 21	60°	55°	50°	44°	39°

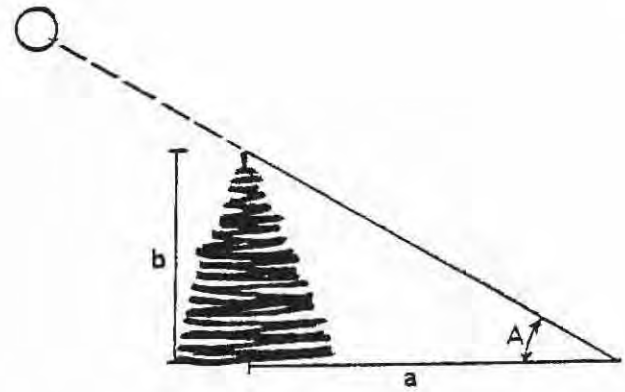
Example: To determine the noon shadow pattern of a 35' pine tree in central Illinois, use the above chart for 40°N latitude and determine the solar altitude for Dec. 22. By using trigometry we can determine the shadow to be 68" long.

<A = solar altitude
a = shadow length
b = height of tree

$$a = \frac{b}{\tan A}$$

$$a = \frac{35}{\tan 27^\circ}$$

$$a = 68'$$



Dust

In dry climates, windbreaks are effective filters for blowing dust. The filtering is important for highway visibility and air quality in residential areas.

Sight Distance

When intersections are not controlled by signs, windbreaks should be designed to allow a view of oncoming traffic. The general rule of thumb requires 2 seconds for perception and reaction, plus 1 second to actuate braking; thus 3 seconds of viewing time are required. To calculate the distance needed to provide each driver 3 seconds of viewing time, determine the speed limit and the distance that is travelled in 3 seconds (table 2). This distance is then measured from the corner and a triangle can be formed by connecting the two sides. Plantings that obstruct the driver's vision should not be made in this triangle. (figure 12)

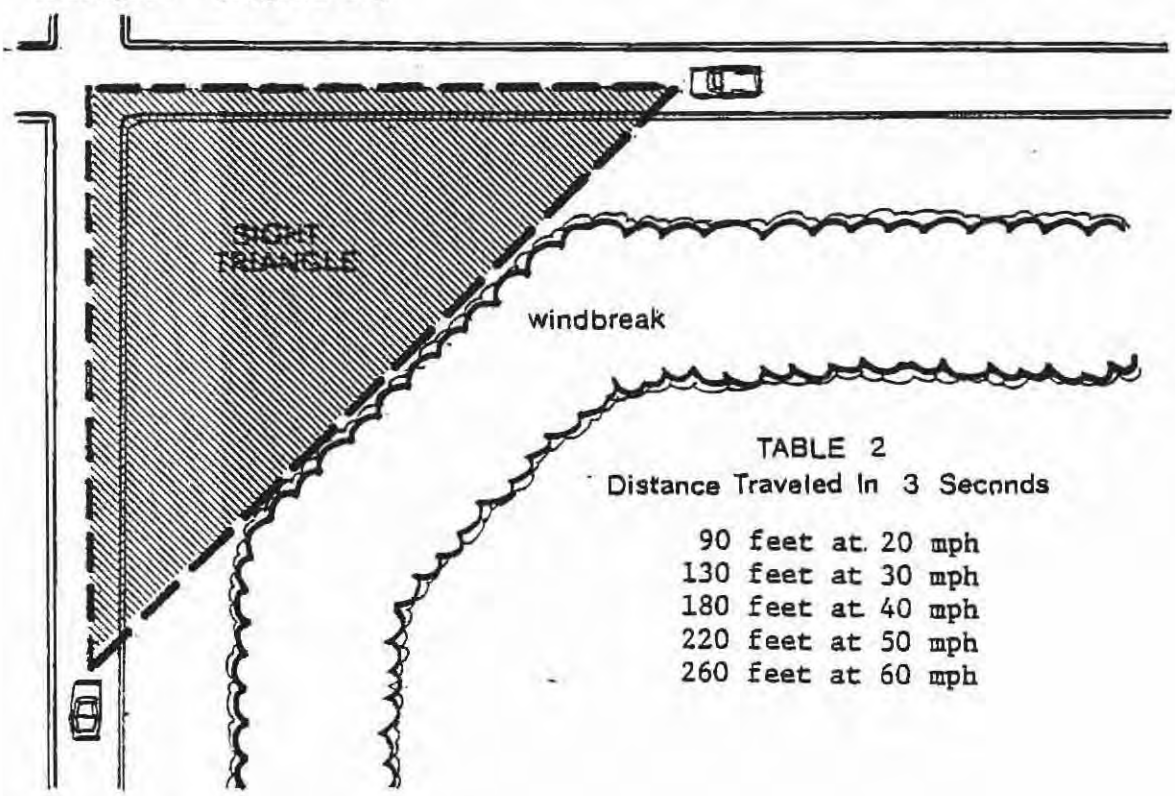


TABLE 2
Distance Traveled In 3 Seconds

90 feet	at 20 mph
130 feet	at 30 mph
180 feet	at 40 mph
220 feet	at 50 mph
260 feet	at 60 mph

figure 12