PROGRESS REPORT on PLANTING for SCREENING HEADLIGHT GLARE and for TRAFFIC GUIDANCE

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THE NEED FOR PLANTING TO SCREEN HEADLIGHT GLARE IS AFFECTED BY THE GEOMETRIC DESIGN OF THE HIGHWAY

Newly planned limited access high-speed expressways designed and constructed on a right-of-way of at least 300 feet should not create any extensive need for planting to screen headlight glare of oncoming motor vehicles.

The acquisition of a wide right-of-way permits a more flexible location of the roadways and adjustment of the profiles to fit the existing terrain with the minimum amount of cut or fill. As a direct result, wider natural wooded areas may be allowed to remain undisturbed between opposing roadways. Where the median strip is designed and constructed with a minimum separation of 50 feet, very little need for planting for screening headlight glare is necessary, because the existing native growth provides an effective immediate screen (Figs. 1 and 2).

Figure 1. Acquisition of wide right-of-way permits a more flexible location of the roadways and adjustment of the profiles so that large areas of native trees and shrubs may be conserved as a headlight-glare screen. View of Garden State Parkway. (Courtesy New Jersey State Highway Department)

When the geometric design standards for the median are reduced below 50 feet in width, the need for planting for screening headlight glare becomes very apparent. This need for screen planting is greatly increased when upper-beam headlamps are in

Figure 2. Varying width of median on the Palisades Interstate Parkway allows native woodland growth to remain undisturbed between opposing roadways. (Courtesy New Jersey State Highway Department)

use. At short distances of about 200 feet the luminance values for the upper beams are about ten times those for lower beams. At distances greater than 200 feet the upper beams give fifteen to twenty-five times the luminance for lower beams. From these data, one can readily see why it is important to be able to have the upper-beam headlamps continuously in operation when driving at maximum speed. The elimination of the need for constantly changing headlamps from upper beam to lower beam reduces driver fatigue and greatly increases safety.

Where the median is 50 feet or more, the planting cost for screening headlight glare may be kept to the minimum. Planting to control the headlight-glare problem

Figure 3. Nerium oleander in median and along right-of-way on California 4B, Fresno. (Courtesy Division of Highways, California Department of Public Works)

Figure 4. Arecastrum romanzoffianum and Eucalyptus sideroxylon rosea planted at bridge piers and abutments of the Fair Oaks Avenue Bridge, Pasadena Freeway, to emphasize the restricted roadway. (Courtesy Division of Highways, California Department of Highways)

Figure 5. Effective red cedar and sugar maple planting in 20-foot median on the Merritt Parkway, Connecticut. (Photo by Charles Brennen)

Figure 6. Planting for screening headlight glare, consisting of mountain laurel, flowering dogwoods, and pin oaks, on the Merritt Parkway in Connecticut. Underplanting of mountain laurel produces an excellent year-round evergreen screen. (Photo by Charles Brennen)

will occur only where the horizontal curvature of the alignment allows the lights of the opposing motor vehicle to shine across the median into the eyes of the driver traveling in the opposite direction.

Vertical curvature of roadways will permit oncoming headlights to penetrate over the tops of the planting unless the sight lines on the highway profiles are plotted in order to determine the exact height of plant material required.

When the design standards allow a narrower median, the problem of eliminating headlight glare by screen planting becomes more acute.

PROGRESS IN SCREENING HEADLIGHT GLARE

Recently, more attention has been given to functional planting of native trees and shrubs, as well as the use of Rosa multiflora (Japanese rose) for

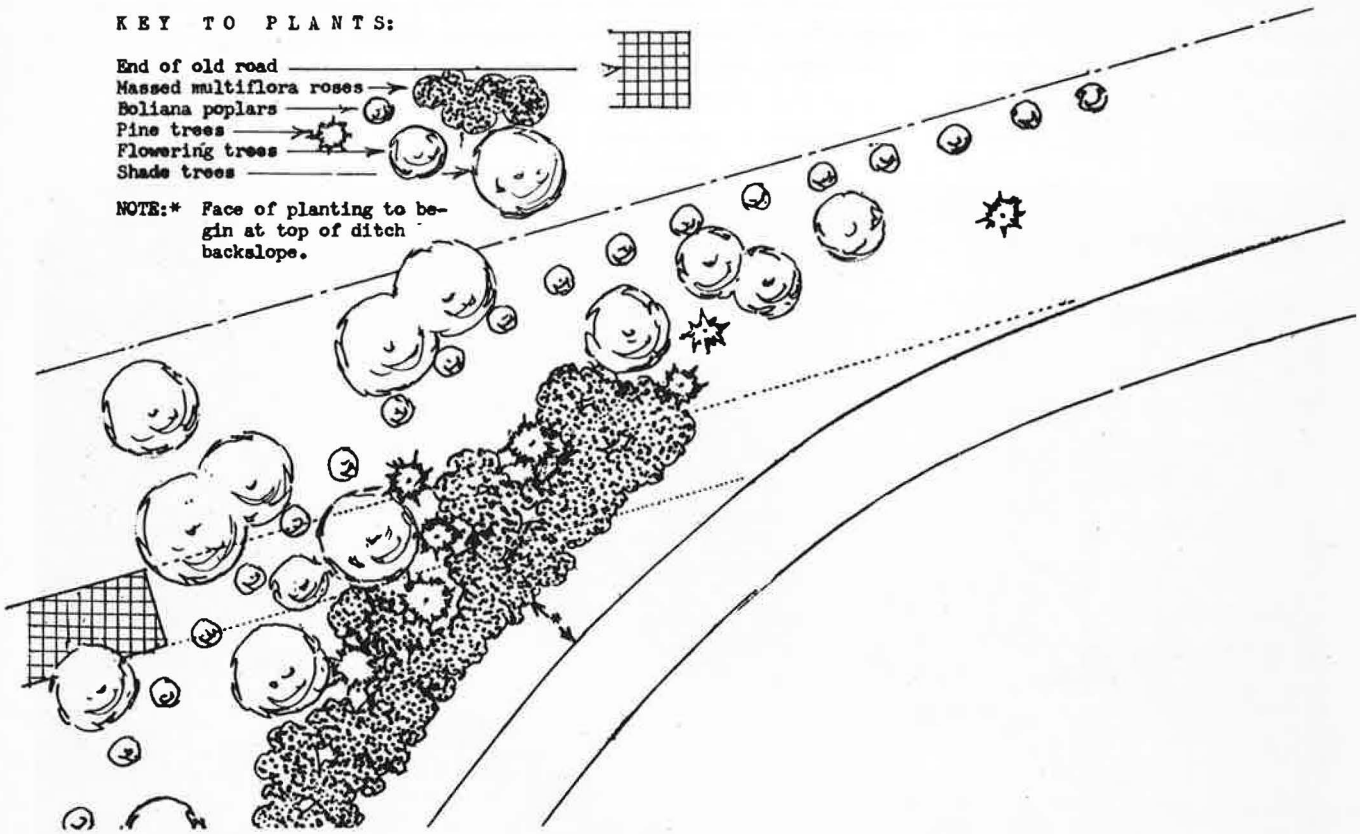


Figure 7. Sketch of a suggested planting plan to screen old road at beginning of new alignment. (Courtesy Division of Highways, Illinois Department of Public Works and Buildings)

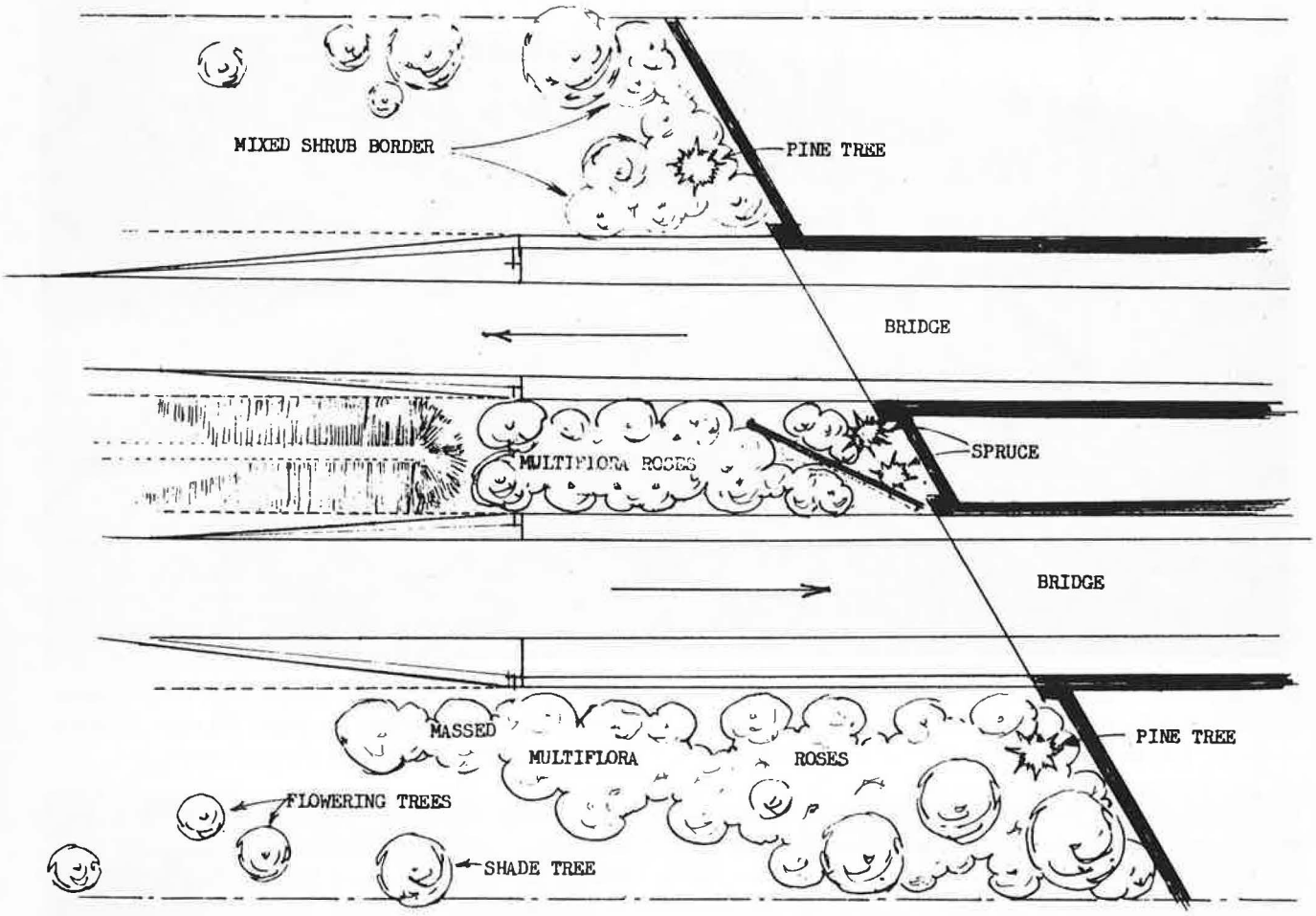


Figure 8. Treatment at ends of parallel bridges on dual highways. (Courtesy Division of Highways, Illinois Department of Public Works and Buildings)

screening headlight glare and for traffic guidance for public safety. The eleven states that have reported interest in this problem of planting to screen out headlight glare and for traffic guidance are California, Connecticut, Illinois, Kansas, Louisiana, Minnesota, New Jersey, New York, North Carolina, Oregon, and Virginia. Some of these states have done considerably more planting of this type than others, but all have planted to a limited degree.

California

California Department of Public Works, Division of Highways, has planted Nerium oleander 6 feet apart in the median and along the right-of-way fences. These plants will grow to a height of 5 to 8 feet. This type of plant material in this section of the country produces a very effective and attractive screen (Fig. 3).

Plantings of Arecastrum roman-

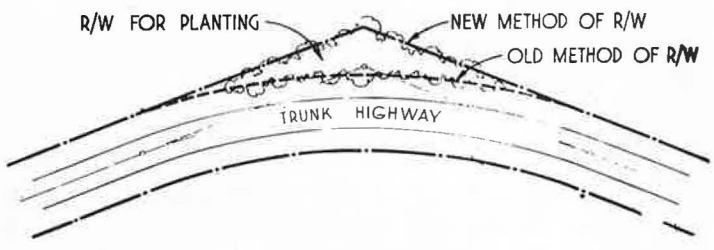


Figure 9. Planting for safety and elimination of signs through acquisition of right-of-way outside of curve. (Courtesy Minnesota Department of Highways)

Figure 10. On US 22, Phillipsburg, Crataegus crusgalli screen planting for headlight glare and traffic guidance, looking toward the Delaware Bridge Plaza. Median measures 15 feet. (Courtesy New Jersey State Highway Department)

zoffianum and Eucalyptus sideroxylon rosea have been used at bridge piers and abutments to emphasize the restricted roadway (Fig. 4). Myrtus communis has been used in the narrow medians. California reports that, because of the very heavy traffic on its freeways and the danger to maintenance personnel working in narrow medians, planting is no longer installed. This is just another reason why the medians should be designed initially wider in order to provide for safety and beauty.

Connecticut

Connecticut has done some very successful planting on the Merritt and Wilbur Cross Parkways. Native trees and shrubs, such as Juniperus virginiana (red cedar), Tsuga canadensis (Canada hemlock), Pinus strobus (white pine), Acer saccharum (sugar maple), Quercus palustris (pin oak), Cornus florida (white flowering dogwood), Kalmia latifolia (mountain laurel), and Ilex glabra (inkberry) have been planted on medians measuring 20 feet wide. Where medians narrow from 20 to 5 to 10 feet, shrubs such as Ligustrum ibota regelianum (Regel's privet), Viburnum dentatum (arrowwood), and Crataegus phaenopyrum (Washington thorn) have been used and proved satisfactory (Figs. 5 and 6).

Illinois

In the spring of 1957 the Division of Highways, State of Illinois Department of Public Works and Buildings, is planting $2\frac{1}{2}$ miles of Rosa multiflora in the median of the Chicago Metropolitan Expressway System as an experiment. The number of plant rows has been determined by the width of the median, which varies from 10 to 50 feet, providing 6 feet of storage space for snow and emergency vehicle stops on each side. The number of rows of roses will vary from one to ten. Most of the medians are 21 feet wide and will be planted with three rows of plants. The rows

are spaced $2\frac{1}{2}$ feet apart, with the rose plants in each row placed on 4-foot centers.

This experimental median planting will be carefully studied to determine its effectiveness as a headlight-glare screen, crash barrier, and snow fence.

The Illinois Division of Highways has prepared some suggested plans for planting to screen out old roads and to guide traffic around curves, because accidents often occur at these points. Motorists have a tendency to drive straight ahead when a pavement is visible in the direct line of travel. This is especially true at night when the gap between the right-angled entrance to the old road and the point of curvature of the new road is not clearly visible. Headlights and tail lights of traffic seen on the old road add greatly to the confusion.

This traffic hazard may be reduced to a great extent by planting deciduous and coniferous trees in those gaps in such a manner as to screen the old pavement from view of the driver and to delineate the curvature of the new alignment. Low-growing flowering trees such as Crataegus and Malus were used extensively to fill in spaces between the lower branches of shade trees and the ground (Figs. 7 and 8).

Louisiana

No extensive planting for screening headlight glare and traffic guidance has been done by the Louisiana Department of Highways. However, some planting to screen out headlight glare was installed in a large traffic circle east of Baton Rouge and is very successful.

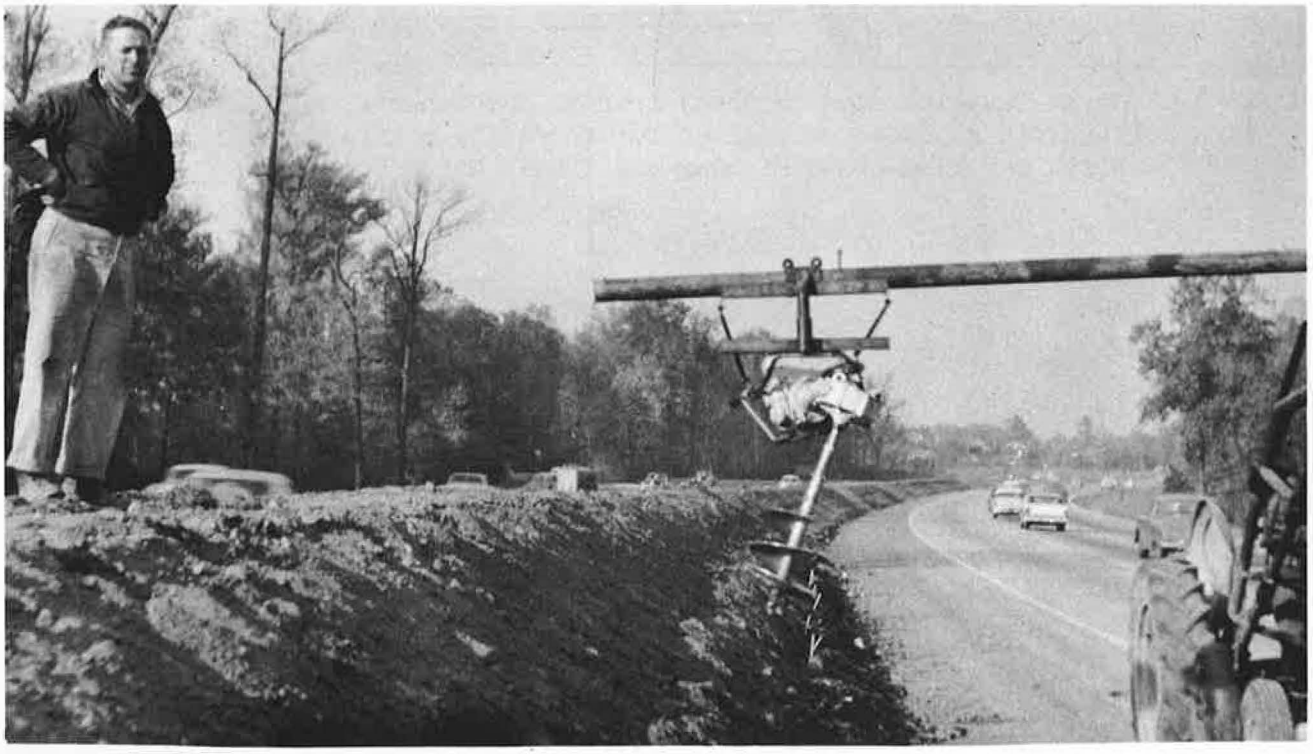


Figure 11. New Jersey's Garden State Parkway, showing mounding of median and planting of the mound with Hall's Japanese honeysuckle. Power auger was used to dig the planting holes for the honeysuckle; autumn, 1956. (Courtesy New Jersey State Highway Department)

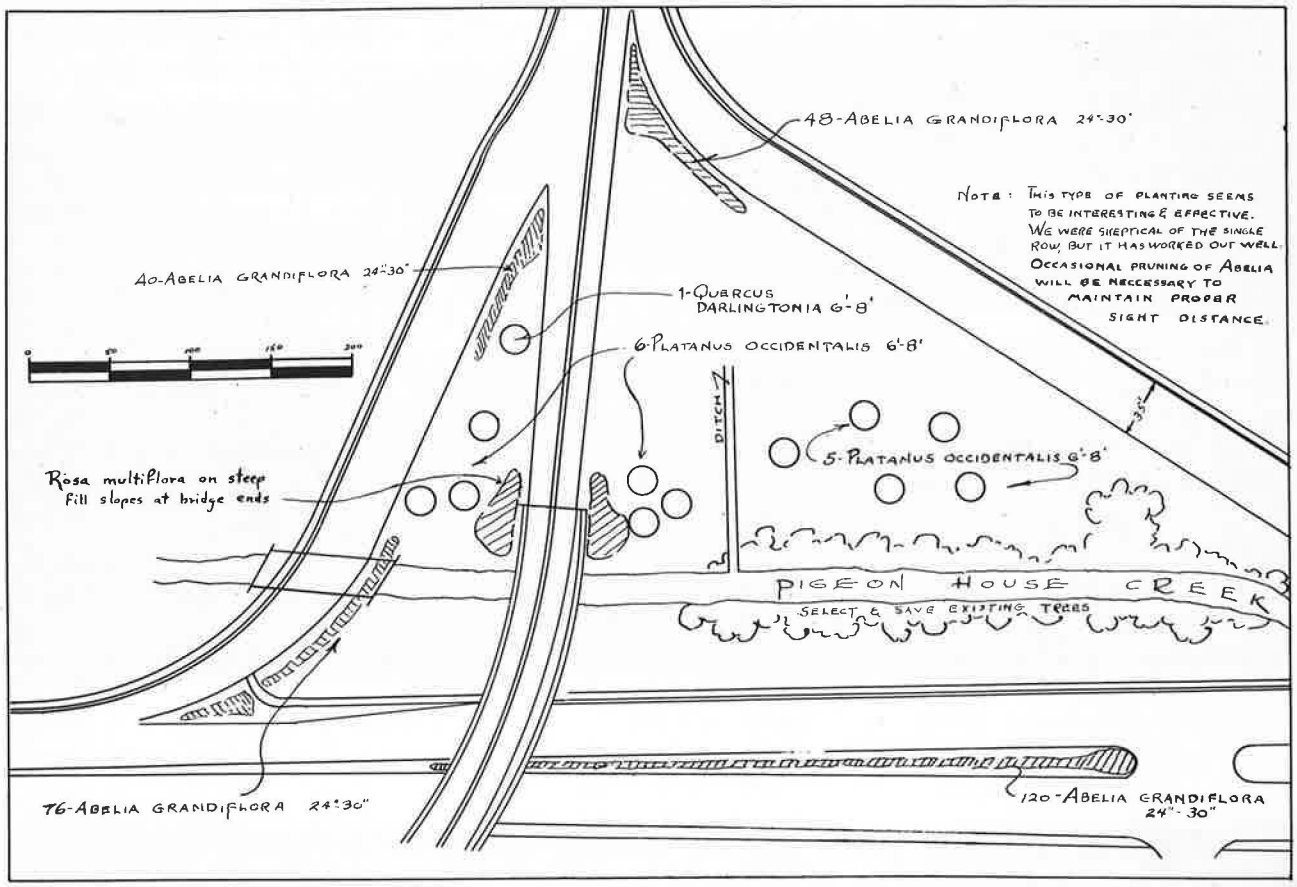


Figure 12. North Carolina state highway traffic interchange, showing functional planting for traffic guidance as well as for screening headlight glare. (Courtesy North Carolina State Highway and Public Works Commission)

Figure 13. A view of the R. H. Baldock Freeway in Oregon, showing the value of a single Douglas fir tree (Pseudotsuga taxifolia) in the median. Opposing traffic lanes are 100 feet apart. (Courtesy Oregon State Highway Department)

Figure 14. A view of the R. H. Baldock Freeway between Salem and Portland, Ore. These natural groupings of Oregon white oak (Quercus garryana) were retained in the median and between the frontage road and the main highway. The opposing lanes are 100 feet apart. (Courtesy Oregon State Highway Department)

Figure 15. A planting of salal (Gaultheria shallon) in a median at McMinnville, Ore. This evergreen plant has served admirably to accent the island without interfering with sight distance at this intersection. The plant has an added virtue; it can be mowed with sickle-bar mowers and retained at any height desired. (Courtesy Oregon State Highway Department)

Figure 16. Planting at Oceanlake, Ore., of native materials: Pacific waxmyrtle (Myrica californica), hairy manzanita (Arctostaphylos columbiana), salal (Gaultheria shallon), and a few shore pines (Pinus contorta). This median island, planted in 1946, has proved effective as a traffic delineator and has eliminated headlight glare. The width of the island varies from 5 to 20 feet. (Courtesy Oregon State Highway Department)

Minnesota

The Minnesota Department of Highways has planted medians with coniferous trees and deciduous shrubs such as the common lilac and Caragana for elimination of headlight glare.

For traffic guidance to delineate the outside of curvature in alignment, both coniferous and deciduous trees combined with shrubs were used. This type of planting has the additional advantage of eliminating signboard locations at the focal points of intersecting tangents (Fig. 9).

New Jersey

During 1956 the New Jersey State Highway Department planted two sections of the

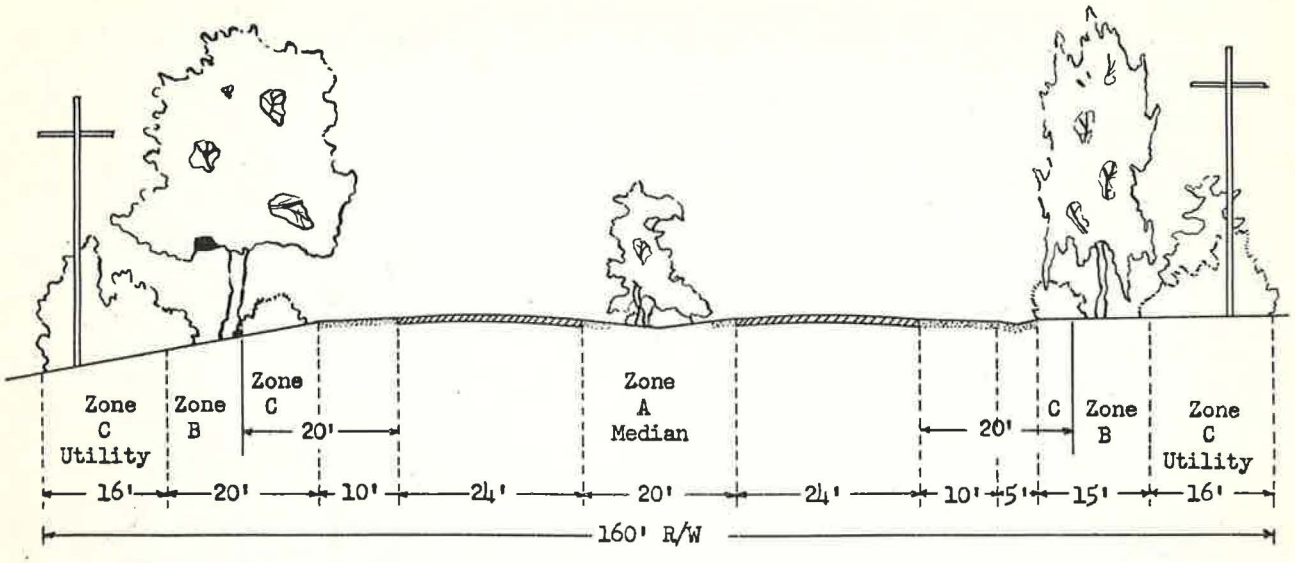
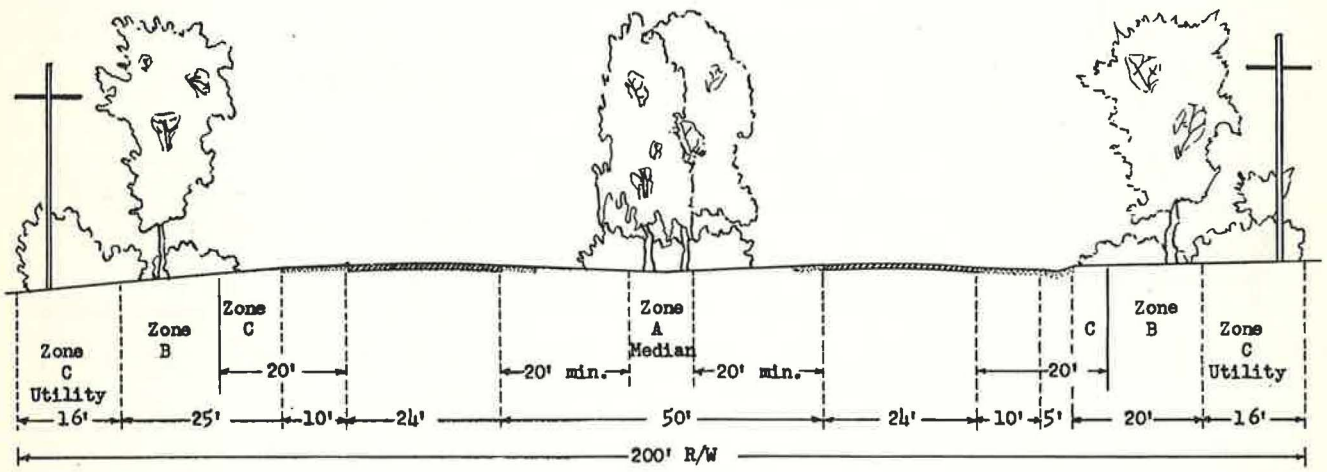


Figure 17. Virginia standards for tree and shrub planting. (Courtesy Virginia Department of Highways)



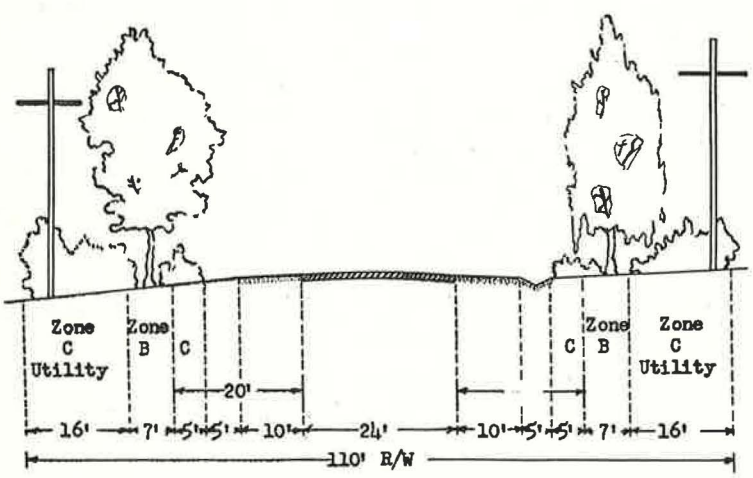


Figure 18. Virginia standards for tree and shrub planting, continued. (Courtesy Virginia Department of Highways)

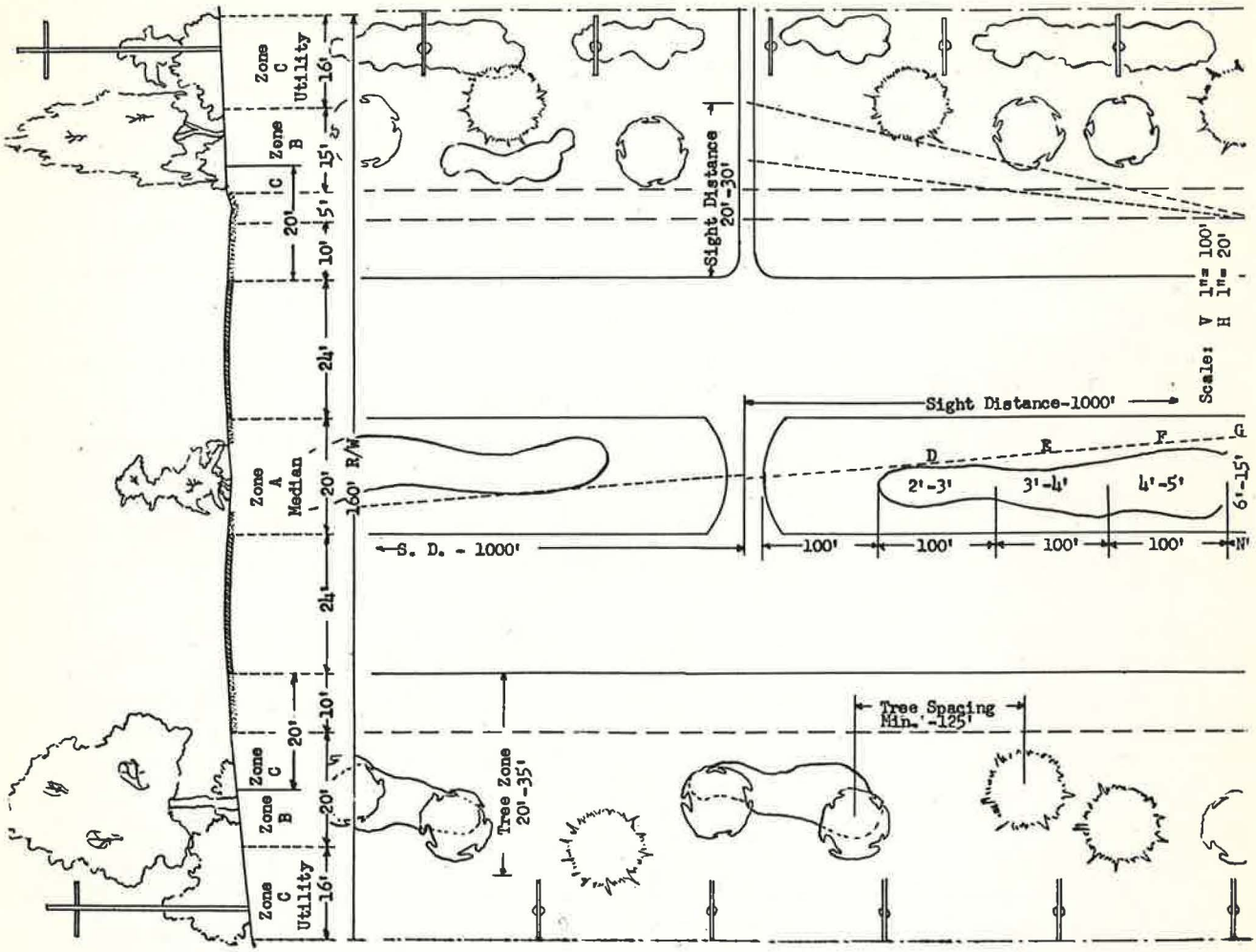


Figure 19. Virginia standards for tree and shrub planting, continued. (Courtesy Virginia Department of Highways)

Palisades Interstate Parkway, as well as a number of state highways, with flowering trees, shrubs, and pines, especially designed for screening headlight glare and for traffic guidance (Fig. 10).

On the New Jersey state highway section of the Garden State Parkway, medians that have recently been narrowed from 54 to 34 feet and less by pavement widening have been mounded with borrow to a height of 4 feet and are being planted with 105,000 2-year old field-grown Lonicera japonica halliana (Hall's Japanese honeysuckle). The vines are being planted on a spacing of one per square yard and are being mulched with 3 inches of salt hay. No topsoiling and seeding of the mounds is being done. This treatment of the medians will serve as a headlight-glare screen, as well as a safety barrier controlling the crossing of the medians by traffic. The semi-evergreen honeysuckle ground-cover planting will reduce to a minimum the need for mowing (Fig. 11).

North Carolina

North Carolina has been doing some effective functional planting of interchange areas for headlight-glare reduction as well as for traffic guidance on the inter-

change ramps. Although a number of kinds of shrubs have been tried, including Ligustrum ibota regelianum (Reagel's privet), Lonicera fragrantissima (winter honeysuckle), Euonymous vegetus (big-leaf winter creeper) and Ilex rotundifolia (round leaf Japanese holly), the shrubs proving to be best suited for these purposes are Abelia grandiflora (glossy abelia), Ligustrum lucidum (glossy privet), Spirea thunbergi (Thunberg spirea), and several species of Berberis (barberry).

It is reported that mixed plantings of shrubs are no longer used in planting design plans. Interesting and effective plantings for screening headlight glare have been accomplished by large masses of one variety of shrub.

Although recent plantings have not yet thickened up to full effectiveness, single-row plantings of Rosa multiflora are proving successful in medians for screening headlights. The rose has also been used on slopes in the vicinity of bridge wing walls (Fig. 12).

Oregon

The Oregon State Highway Department has done some extensive planting for screening headlight glare and for traffic guidance. Twenty-four miles of continuous plantings of Ligustrum vulgare (European privet) and Rosa multiflora (Japanese rose) have been used in the median on the R. H. Baldock Freeway.

At the north entrance to Salem, the median was planted with English holly to delineate the island and eliminate headlight glare. The space between the hollies and the curb will be planted with a ground cover of Gaultheria shallon (salal), which will eventually grow into a solid green cover and will require a minimum of maintenance (Figs. 13, 14, 15 and 16).

Virginia

The Virginia Department of Highways has done a limited amount of median-zone planting for screening headlight glare. It has, however, adopted a "Policy and Standards for Planting Trees and Shrubs" (September 7, 1955), which applies to median-zone planting as well as the roadsides. A list of suitable trees and shrubs for Virginia and vicinity is included (see Tables 1 and 2). This policy and standards (Figs. 17, 18, and 19) may serve as a helpful guide to other state highway departments.

Policy for Planting Trees and Shrubs

1. Trees are not to be planted on roads with less than 110-foot right-of-way.
2. Trees are not to be planted closer than 20 feet from the edge of pavement as indicated in standards.
3. No trees are to be planted in median less than 50 feet wide except flowering trees and shrubs such as abelia, crepe myrtle, small cedars, dogwood, redbud, privet, pfitzer juniper, or as shown in the standards.
4. Exceptions may be made for plantings in urban areas and where the speed limits have been reduced. All exceptions must have approval of the Chief Engineer.

TABLE 1

LIST OF SHRUBS FOR ROADSIDE PLANTING*

		A	B	C	D	E	F	G**
Abelia grandiflora	Glossy abelia (E)	x	x	x			x	
Acanthopanax sieboldianus	Fiveleaf aralia	x	x	x				x
Aesculus parviebora	Bottlebush buckeye	x	x	x				x
Aronia arbutifolia	Red chokeberry	x	x	x				x
A. melanocarpa	Black chokeberry	x	x	x				x
Berberis julianae	Wintergreen barberry (E)	x				x	x	
Berberis thunbergi	Japanese barberry	x			x	x	x	
Callicarpa japonica	Japanese beauty-berry	x	x			x	x	
Calycanthus floridus	Carolina allspice	x	x	x			x	x
Cotoneaster species	Cotoneaster (E)	x	x		x	x	x	x
Crataegus species	Hawthorne	x	x	x				x
Cytisus scoparius	Scotch broom (E)	x	x	x			x	x
Deutzia species	Deutzia	x	x	x				x
Elaeagnus angustifolia	Russian olive	x	x	x			x	x
E. pungenus	Thorny elaeagnus (E)	x	x					x
Euonymus alata	Winged burning bush	x	x				x	x
E. latifolia	Broadleaf euonymus	x	x	x				x
Exochorda grandiflora	Pearlbush	x	x					x
Forsythis species	Forsythia	x	x	x			x	x
Ilex cornuta	Chinese holly (E)	x						x
Ilex crenata	Japanese holly (E)	x	x		x	x	x	x
Ilex glabra	Inkberry (E)	x	x					x
Ilex verticillata	Black alder	x	x	x				x
Ilex vomitoria	Yaupon holly (E)	x			x	x		x
Jasminum nudiflorum	Winter jasmine	x	x				x	x
Kalmia latifolia	Mountain laurel (E)	x	x				x	x
Lagerstroemia indica	Crepe myrtle	x	x					x
Ligustrum species	Privet (E)	x	x	x			x	x
Myrica cerifera	Waxmyrtle (E)	x	x	x			x	x
Myrica pennsylvanica	Bayberry (seashore) (E)	x	x	x			x	x
Osmanthus fortunei	Fortune's osmanthus (E)	x						x
O. ilicifolius	Holly osmanthus (E)	x	x					x
Philadelphus species	Mock orange	x	x					x
Pittisporum tobira	Japanese pittisporum (E)	x	x			x	x	x
P. tobira variegata	Varigated J. Pittisporum (E)	x	x			x	x	x
Pyracantha coccinea	Scarlet firethorn (E)	x	x				x	x
P. Gibbsi	Gibbs firethorn (E)	x	x				x	x
Rhododendron var.	Rhododendron (E)	x	x				x	x
R. azalea var.	Azalea (D-SE-E)	x	x		x	x	x	x
Rhus aromatica	Fragrant sumac (3')		x	x				
R. copallina	Shining sumac (30')		x	x				
R. glabra	Smooth sumac (15'-25')		x	x				
R. typhina	Staghorn sumac (30')		x	x				
Rosa hugonis	Father Hugo rose	x	x				x	x
R. multiflora	Japanese rose	x	x				x	x
R. rugosa	Rugosa rose	x	x				x	x
R. virginiana	Virginia rose	x	x				x	x
R. wichuraiana	Memorial rose (SE)	x	x				x	x
Tamarix species	Tamarix	x	x	x				x
Viburnum davidi	David viburnum (E)	x	x					x

TABLE 1 (Continued)

LIST OF SHRUBS FOR ROADSIDE PLANTING*

		A	B	C	D	E	F	G**
V. henryi	Henry viburnum (E)	x	x					x
V. species	Species viburnum	x	x	x				x
Vitex agnus-castus	Chaste tree	x	x					x
V. negund incisa	Cut-leaved chaste tree	x	x					x
Weigela species	Weigela	x	x					x

*Courtesy Virginia Department of Highways.
**Letters refer to zones shown in Figs. 17 to 19; x's indicate plant material for use in zones as shown.

TABLE 2

LIST OF TREES FOR ROADSIDE PLANTING*

		A	B	C**
Acer platanoides	Norway maple			x
A. rubrum	Red maple			x
A. saccharum	Sugar maple			x
Aesculus glabra	Ohio buckeye			x
A. hippocastanum	Horsechestnut			x
Betula lenta	Sweet or black birch			x
B. nigra	River birch			x
Cedrus deodara	Deodar cedar	x	x	x
Celtis occidentalis	Hackberry	x	x	x
Cercis canadensis	Redbud	x	x	x
Cornus florida	Flowering dogwood	x	x	x
C. florida rubra	Red-flowering dogwood	x	x	x
Fraxinus americana	White ash			x
F. pennsylvanica lancgolata	Green ash			x
Gleditsia triacanthos	Honey locust			x
G. triacanthos moraine	Thornless honey locust			x
Ilex opaca	American holly	x	x	x
Juniperus virginiana	Red cedar	x	x	x
Liquidambar styraciflua	Sweet gum			x
Liriodendron tulipifera	Tulip tree			x
Pinus glabra	Spruce pine	x	x	x
P. resinosa	Red pine	x	x	x
P. strobus	Eastern white pine	x	x	x
P. taeda	Loblolly pine	x	x	x
P. virginiana	Virginia scrub pine	x	x	x
Platanus occidentalis	Planetree			x
P. orientalis	Oriental planetree			x
Quercus alba	White oak			x
Q. coccinea	Scarlet oak			x
Q. montana	Chestnut oak			x
Q. palustris	Pin oak			x
Q. phellos	Willow oak			x
Q. velutina	Black oak			x
Q. virginiana	Live oak			x
Robinia pseudoacacia	Black locust			x
Salix babylonica	Babylon weeping willow			x

(Continued)

TABLE 2 (Continued)

LIST OF TREES FOR ROADSIDE PLANTING*

		A	B	C**
Tsuga canadensis	Canada hemlock	x	x	x
Ulmus alata	Winged elm			x
U. americana	American elm			x

*Courtesy Virginia Department of Highways.
**Letters refer to zones shown in Figs. 17 to 19; x's indicate plant material for use in zones as shown.

CONCLUSIONS

1. Planting for screening headlight glare and for traffic guidance may be kept to a minimum by adopting highway design criteria that will establish a cross-section with a minimum ultimate median of 50 feet or greater, wherever property values permit.

2. Adopting a policy of conservation practices during design and construction will reduce to a minimum the necessity for median planting for headlight screening.

3. Properly designed median plantings will not only reduce headlight glare and serve as a guide for traffic traveling over a changing alignment, but also will allow motorists to drive with high-beam headlamps continuously in use. This will increase night driving visibility at least fifteen times over low-beam driving.

4. Median plantings, to be effective, must ultimately measure $4\frac{1}{2}$ to 5 feet in height and be composed of plant material that will provide a dense twig growth. Combination plantings of coniferous trees, broad-leaf evergreens, and deciduous shrubs are most effective for year-round use.

5. Median-zone plantings may prove to provide additional benefits, such as serving as effective crash barriers, preventing vehicles and pedestrians crossing medians, replacing guide rail, and eliminating its yearly maintenance cost and periodic replacement.

6. Planting of trees and shrubs on curves in back of guide rails will help to make such fixed barriers easier to detect during night driving, as well as to aid in warning the driver of a changing alignment.

7. Plantings of trees and shrubs in traffic circles and grade separation ramps have proved to be helpful warnings to motorists to slow down.

8. Median-zone plantings will present varying maintenance problems in urban areas as compared with rural areas. Studies and observations of such plantings should be made before undertaking an extensive planting program.

9. Further research and experimentation of functional highway planting for safety, comfort, and relief of driver fatigue should be carried on by all highway departments.

ACKNOWLEDGMENT

Much of the information and many of the fine photographs illustrating planting for screening headlight glare and traffic guidance have been freely contributed by landscape engineers and landscape architects from numerous state highway departments throughout the United States.

Grateful acknowledgment is made to the contributing State Highway Departments of California, Connecticut, Illinois, Kansas, Louisiana, Minnesota, New Jersey, New York, North Carolina, Oregon, and Virginia. The author is especially appreciative of the information and help furnished by H. Dana Bowers, Supervising Landscape Architect, Division of Highways, California Department of Public Works; J. P. Tuthill, District Engineer, and Albin Gries, Landscape Architect, Division of Highways, Illinois Department of Public Works and Buildings; Frank Brant, Landscape Engineer, North Carolina State Highway and Public Works Commission; Mark H. Astrup, Landscape Engineer, Oregon State Highway Department; and Harold J. Neale, Landscape Engineer, Virginia Department of Highways.

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4. "Expressway or Parkway, Desirable Design Factors Underlying Highway Construction," Reprinted from Landscape Architecture for April 1954 and April 1955 by Highway Research Board, Committee on Roadside Development, 1956.

5. "Effect of Planting in Median Strip on Night-Visibility Distances," Night Visibility, Highway Research Board Bulletin 89, as presented at the 33rd Annual Meeting in 1954.

DISCUSSION

A discussion of some of the problems of planting to control headlight glare on state highways was submitted by C. M. Hatton, Junior Landscape Architect, New York State Department of Public Works, as follows:

Several sections of highways in New York State have been planted with the objective of obscuring the glare of headlights from oncoming traffic. On some sections the results have been considered satisfactory for a period of years, but because of numerous factors, such as the inability of the regular maintenance crews to care for the plants adequately, several plantings have not been satisfactory. These plantings are described in the following report to emphasize the difficulties that should be borne in mind when such plantings are being considered. In all but the case of the Henry Hudson Parkway and portions of the Hempstead Turnpike in Roslyn, the space for planting was considered adequate. The outlines of beds were adjusted as well as practical to favor machine mowing, and the plants used were initially considered to be thoroughly appropriate.

1. The Maywood-Babylon Road is a dual highway, north of Babylon, Long Island. It has a median that is generally 30 feet in width. Because of horizontal curves and grades, a planting was made in the median area for about $1\frac{1}{2}$ miles along this highway to control headlight glare. The planting was confined to a strip about 10 feet wide, leaving 10-foot-wide grass shoulders on either side. These open areas were also intended to favor the mowing pattern. The planting plans required careful checking in the field to avoid blocking vision near intersections and crossovers and at the same time screen headlights on the curves.

The predominant shrubs used for this planting were Vaccinium corymbosum 3 to 4

feet high with lesser amounts of Ligustrum ibota 4 to 5 feet high and Viburnum dentatum 5 to 6 feet high. Crataegus in variety, 6 to 10 feet high, and Pinus strobus, 5 to 8 feet high, were added to achieve variation in the height effect. The planting has been established for five years.

The mowing pattern of the median has been interrupted to an objectionable extent. Weeds growing between the shrubs have given an unsightly appearance and have adversely affected the plant growth. Plant losses from natural causes have been negligible, but damage has occurred from vehicles illegally crossing the median, and no replacements have been made. Papers and trash collect between the plantings.

The extra burden of mowing around the beds and picking up litter, and the impossibility for the limited maintenance forces to do weeding, have resulted in a generally unsightly and unkempt appearance. Lack of watering, particularly when the plants were becoming established as well as during several periods of severe drought, has adversely affected plant growth. The plantings do not even yet effectively control headlight glare during all seasons of the year.

2. East of the Roslyn Viaduct on the Hempstead Turnpike, Roslyn, Long Island, the road alignment and grade cause a problem of headlight glare. A planting was installed five years ago for a length of about 1/3 mile in the median area. The median varies in width from 6 to 24 feet.

This planting consisted of masses of Viburnum dentatum 5 to 6 feet high, Elaeagnus umbellata 6 to 8 feet high, and Ligustrum ibota 4 to 5 feet high, with Ilex glabra 2 to 3 feet high as underplanting to face down these taller shrubs. A few Carpinus betulus 8 to 12 feet high were also used. Maintenance problems and the resulting ineffectiveness of the plantations to obscure headlight glare are similar to the preceding situation.

3. In the fall of 1950 a site was selected at a long curve on the New York State Thruway north of the Saugerties interchange for a demonstration planting to screen headlight glare. The median is 44 feet wide at this point. It has a depressed cross-section, and the plantings occur as single-row hedges on one or both sides of the ditch.

Several horticulturists and nurserymen were consulted, and many plants were studied in the field before selecting the shrubs to be tested. Acanthopanax seiboldianus 4 to 5 feet high was planted on 3-foot centers and Cornus mas 5 to 6 feet high was planted on 5-foot centers. These two kinds were either winter-killed or damaged and have since disappeared. Ligustrum obtusifolium 5 to 6 feet high, Viburnum dentatum 3 to 4 feet high, and Rosa multiflora 4 to 5 feet high were each planted on 4-foot centers and still exist. The roses suffered winter injury the first year and had to be cut back practically to the ground level. After five years' growth, however, they were considered effective for the first time, but the two other kinds of shrubs are still too irregular to be classed as satisfactory in controlling headlight glare. Maintenance problems on this project were characteristic of those experienced on the plantings previously mentioned.

4. About 20 years ago several kinds of shrubs were planted in the $5\frac{1}{2}$-foot median of the Henry Hudson Parkway where it passes theough the Riverdale section of the Bronx. Some of these hedges, particularly those planted with Crataegus, are still in place and help screen the oncoming headlights. Even these hawthorns have thinned out considerably, and long sections of them have a dense twiggy growth for top 18 inches or so, but below this have an open, leggy character. These particular plants have outgrown their usefulness in such a severe growing condition and should be replaced. It has been necessary to close the nearby lanes of traffic in

order to protect workmen when these hedges are being cleaned out and pruned.

The data presented indicate some of the problems which may be expected as a part of plantations of this character. It is not to be expected that these problems would preclude all planting to control headlight glare any more than that consideration of original cost of installation would preclude such planting. It is rather to be hoped that this report will call attention to factors which should be considered at an early stage of highway design.

It would seem only reasonable to compare the cost of construction and maintenance of an adequately designed highway with that of one requiring planting as a means of controlling headlight glare.