SELECTIVE CUTTING OF ROADSIDE VEGETATION
FOR
IMPROVED HIGHWAY SAFETY
APPEARANCE AND USE

NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL
HIGHWAY RESEARCH BOARD

SELECTIVE CUTTING OF ROADSIDE VEGETATION

FOR

IMPROVED HIGHWAY SAFETY

APPEARANCE AND USE

Prepared as a Special Assignment
for the Roadside Development Committee
of the Highway Research Board by

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Washington 25, D. C.

1957
FOREWORD

Very much as the engraver and the etcher have cut away material to create a composition, so have the landscape architect and landscape engineer created roadside pictures by cutting away trees and shrubs. Many times the composition is made on the job, dictated by the imagination, artistry and judgment of a trained mind and eye. Very few of these pictures have been described by text or drawing before their creation; not many of them have been described after their creation.

This report will have served its purpose if it shall have spoken for the landscape architects and landscape engineers whose "roadside pictures" remain undocumented, and shall have expressed for them some of the principles and practices they have followed.

Appreciation is extended to those who have had an opportunity to plan and to record their work. For their contribution to this report the author is greatly indebted.
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- View of Hudson River and Manhattan Island from Palisades Interstate Parkway, New Jersey.

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INTRODUCTION

The proper blending of many factors is necessary if a road is to serve satisfactorily the purposes for which it is intended. Factors such as adequate engineering design standards that reflect complete analysis and correct interpretation of a road's functions; up-to-date construction practices with approved materials and modern equipment; timely maintenance, repair and improvement; -- all these contribute to the successful use of a traffic facility, whether that facility is a high standard, multilaned, arterial expressway or parkway carrying a large volume of unrestricted or selected types of vehicles, or a low standard, small volume, all purpose road winding its way through a desert canyon or a forested mountain.

The factors of design, construction and maintenance may be considered to have certain tangible or "exact" properties because they may be used in terms of mathematical formulae or tabulations, engineering principles or physical properties. For instance, there are definite relationships between vehicle speed, road grades, degrees of curvature and superelevation; the sizes of ditches and drainage openings may be determined from rate of precipitation, time, runoff
area and rate of flow; and the properties of steel, concrete, stone, wood and other materials have been established within close limits. A sought-for dimension, weight or force for any of these factors may be calculated precisely by properly resolving problem requirements, engineering formulae and material characteristics.

However, a road that has been well-designed, properly constructed and adequately maintained from an engineering point of view may not be a road that is pleasant or safe to drive from another point of view. It may be axiomatic, perhaps, that within certain prescribed specifications, any vehicle may be propelled by any person along any road at any given speed, whatever the physical limits of the considered factors of design, construction and maintenance may be.

But, up to this point, one other factor, a very important one, may not have been considered. It is one that can well determine whether a road is completely successful or merely adequate. It is the factor of driver behavior.

In considering driver behavior and its effect upon highway design, construction and maintenance, one is concerned, largely, with intangibles. The social, physiological and economic interrelationships of psychology, sensory perception and emotional reaction are not, in themselves, exactitudes, and cannot be stated with the same definitiveness that one can use in considering such exact sciences as mathematics,
physics and chemistry. However, the thoughtful study of the various elements of driver behavior as they relate to a road and its environs may result in conclusions that can be resolved and applied in terms of specific design, construction and maintenance. An understanding of driver fatigue, for instance, may result in an improved highway alignment that has shorter tangents and longer spirals in order to offset induced hypnosis and its resultant reflex lag. Driver safety may be increased through the use of grade separations, limited accesses and controlled ribbon developments, which in turn may retard highway obsolescence and result in increased community and regional economies and benefits. Safety and pleasure in driving may be improved through the use of trees, shrubs and other materials as barriers for the reduction of headlight glare, the screening of objectionable roadside development, the diminishing of traffic noises and distracting movements, and the reduction or diversion of winds and snow drifts. The selective thinning or removal of vegetation may result in increased sight distance and safety at accesses and on curves, and may give greater driving pleasure by creating vistas that will enable the motorist to view and enjoy the special interests of the roadside along which he is traveling.

Each of the many components of driver behavior is deserving of individual treatment, and for most of them considerable research has been done and much material written.
Although selective cutting and removal of vegetation along roadsides has been practiced for some time, very little material has been written on the subject and not much of that material has been collected. It is in the special interest of this particular subject, "the selective cutting and removal of vegetation along roadsides," that this report is written.

U. S. Highway 240, south of Hyattstown, Maryland, after selective cutting of vegetation. Maryland State Roads Commission
SAFETY

SIGHT DISTANCE ON CURVES AND INTERSECTIONS

A discussion of the selective removal of vegetation from roadsides should revolve around two points of view - that of the driver of a car and that of his passenger. The driver is concerned, for the most part, in manipulating his vehicle, observing traffic control devices and being watchful of the behavior of other vehicles. His primary interest is in the safety and driving ease of himself and of his passenger, if any. He cannot afford to become preoccupied in the interests or attractions of the roadside. He is pleased with and grateful for the use of any principles or devices employed by highway engineers in the design and construction of the road that have made the task of driving more safe and more pleasant, even though he may not be able to indicate or describe exactly what it is that has caused his driving to be less of a chore.

Until recently, not much thought or study had been given to this aspect of driver behavior. The comparatively new, and greatly accelerating change in the transportation pattern - the development of cars of great power capable of
high speed, an economy that encourages more persons and enterprises to own more cars and to drive them more miles, and a resultant increase in traffic volume - have caused highway engineers to be aware of the need for roads of high standard with all possible safety features. As circumstances require and permit, new roads are built to predetermined standards and existing roads are reconstructed to improved standards.

On new roads, safety features are being "built in."

A feature such as adequate sight distance on curves and at intersections has become an accepted element of good design. It is highly desirable that the driver of any vehicle be able to see far enough ahead while rounding a curve or approaching an intersection to be able to bring his vehicle to a full safe stop if required. No tree, shrub or other object should obscure his vision. The physical dimensions of a desired sight distance can be computed with reasonable accuracy through the proper use of certain known and assumed factors. These factors are road curvature, gradient and superelevation; vehicle speed and rate of deceleration; and stopping distance. The first three - curvature, gradient and superelevation - determine the speed of a car at any given point. The next two - vehicle speed and rate of deceleration - determine the distance required to bring the car to a full stop. Stopping distance determines sight distance requirements.
Some research and experimentation in this phase of highway design has been made by traffic and highway organizations and some statistics have been published by them. The Institute of Traffic Engineers and the National Conservation Bureau have published jointly the "Traffic Engineering Handbook," and the American Association of State Highway Officials has published "A Policy on Sight Distances for Highways." A Special Task Committee of the Roadside Development Committee, Highway Research Board, has collated much of the above material and published it in tabular and figure form in "Special Report 23, Planning and Management of Roadside Vegetation, An Analysis of Principles, 1956." Some of the tables and figures and portions of the text of "Special Report 23" have been reproduced for the purposes of this article.

Table 1, based on "Traffic Engineering Handbook," shows vehicle speed with relation to curves and superelevation. Because some drivers can negotiate curves at greater than their designed speed in some circumstances, speeds shown in the table are about 20 per cent higher than in the referenced text to include this "overdrive" ability.

Table 2, based on "Traffic Engineering Handbook" and "A Policy on Sight Distances for Highways," shows basic time values given for mental perception and braking reaction at certain initial vehicle speeds.

Table 3 shows that the distance effected by ascending or descending gradients in the road profile affects the rate of vehicle deceleration.
### TABLE 1

**MAXIMUM PROBABLE SPEEDS FOR VARIOUS CURVE RADII**

<table>
<thead>
<tr>
<th></th>
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</thead>
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<tr>
<td>100</td>
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<td>800</td>
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<td>47</td>
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<td>700</td>
<td>56</td>
<td>65</td>
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</table>

### TABLE 2

**STOPPING DISTANCES FROM VARIOUS VELOCITIES AND AT VARIOUS DECELERATION RATES**

<table>
<thead>
<tr>
<th>mph.</th>
<th>12 mph./sec.</th>
<th>10 mph./sec.</th>
<th>8 mph./sec.</th>
<th>6 mph./sec.</th>
<th>4 mph./sec.</th>
<th>2 mph./sec.</th>
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<tbody>
<tr>
<td></td>
<td>feet</td>
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<td>380</td>
<td>425</td>
<td>495</td>
<td>690</td>
<td>1,100</td>
</tr>
<tr>
<td>70</td>
<td>470</td>
<td>455</td>
<td>520</td>
<td>620</td>
<td>820</td>
<td>1,440</td>
</tr>
</tbody>
</table>

### TABLE 3

**EFFECT OF GRADE ON STOPPING DISTANCES**

<table>
<thead>
<tr>
<th>Assumed Design Speed</th>
<th>Upgrade Decrease in Stopping Distance, feet</th>
<th>Downgrade Increase in Stopping Distance, feet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%3%</td>
<td>%6%</td>
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<tr>
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<td>-0</td>
<td>-10</td>
</tr>
<tr>
<td>40</td>
<td>-10</td>
<td>-10</td>
</tr>
<tr>
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</tr>
<tr>
<td>60</td>
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<td>-30</td>
</tr>
<tr>
<td>70</td>
<td>-30</td>
<td>-50</td>
</tr>
</tbody>
</table>
Sight distance is plotted from tables 1, 2 and 3 as follows: from Table 1 select the maximum speed shown for a curve of a given radius; from Table 2 select the stopping distance required for the selected speed according to a selected rate of deceleration (adjusted to gradient from Table 3); plot the stopping distance along the line of travel on the curve; plot the chord between the beginning and ending of the stopping distance. The sight distance area is the area formed by the arc of the curve and the chord. The plotting of a succession of such chords will define the sight distance zone within which no tree, shrub or other obstruction should be permitted. (Figure 1.)

If the limitation of planting zones by this method results in an uninterrupted and uninteresting planting outline, it may be possible to justify a few plants within the restricted zone in order to soften the outline. They should be scattered and few in number. Existing trees permitted to remain should be high-headed; their presence may cause no real sight restriction until their trunks become large. In any instance, the use of grass or low ground cover plants should be encouraged.

The application of the formula to a great number of curves has proved that within the limitations of the formula adequate sight distance as well as a satisfactory planting design may be achieved.

Where sight distance at highway intersections is to be determined, Tables 1, 2 and 3 are used.
SELECTIVE CUTTING ZONE
FOR
SIGHT DISTANCE ON HIGHWAY CURVES

NOTES
1. REFER TO TABLES 1, 2 AND 3 FOR SPEEDS AND STOPPING DISTANCES
2. SELECT DECELERATION RATE IN KEEPING WITH THE CHARACTER OF THE HIGHWAY
3. ALWAYS COMPUTE FOR SIGHT DISTANCES ON RIGHT HAND CURVES
4. SCALE ALL STOPPING DISTANCES ALONG THE ROUTE OF TRAVEL OF THE VEHICLE
5. SELECTIVE CUTTING ZONE DETERMINED BY CHORD OF ARC OF STOPPING DISTANCE

Minimum distance of ditch and shoulder

Drawn from PLANNING AND MANAGEMENT OF ROADSIDE VEGETATION, HIGHWAY RESEARCH BOARD, 1956

DRAWN BY DISQUE

Figure 1.
When two highways cross one another at separate levels and no interchange of traffic is involved, sight distance is of consideration only when one or both of the roads crosses on a curve, in which case the sight distance for the curve must be computed.

At simple intersections the following formula may be used for computing sight distance; determine the vehicle speed of the intersecting highways and increase these speeds by 20 per cent of "overdrive"; compute from Tables 2 and 3 the stopping distances for these speeds. The plotting of these distances and their sight distance chords will define the clear-vision zones. (Figs. 2 and 3)

When two highways cross at the same grade or are separated by a structure and there is an interchange of traffic, adequate sight distance as a safety factor is of great importance. Here again, the tables are used to determine the necessary sight distance zones within which planting should be restricted. Examples of restricted planting zones based on sight distance for a variety of intersection designs are shown in Figures 4 and 5.

Many roads traverse mountainous country having high scenic and other natural values. The design requirements for these roads usually consider a slower speed, sharper curve, steeper grade, and a narrower pavement and shoulder width indicated by the character of the terrain. Very often these
SELECTIVE CUTTING ZONES
FOR
SIGHT DISTANCE AT HIGHWAY INTERSECTIONS

DESCRIPTION OF ZONES
1. GRASS OR LOW GROUND COVER ONLY
2. INTERMITTENT PLANTING ONLY
3. TREE AND SHRUB PLANTING PERMISSIBLE
4. TREE AND SHRUB PLANTING DESIRABLE
5. SHRUB PLANTING ONLY PERMISSIBLE AND DESIRABLE

Source material same as Figure 1

DRAWN BY DISQUE.

Figure 2.
SELECTIVE CUTTING ZONES
FOR
SIGHT DISTANCE AT HIGHWAY INTERSECTIONS

DESCRIPTION OF ZONES
1. GRASS OR LOW GROUND COVER ONLY
2. INTERMITTENT PLANTING ONLY
3. TREE AND SHRUB PLANTING PERMISSIBLE
4. TREE AND SHRUB PLANTING DESIRABLE
5. SHRUB PLANTING ONLY PERMISSIBLE AND DESIRABLE

Source material same as Figure 1

DRAWN BY DISQUE.

Figure 3.
SELECTIVE CUTTING ZONES FOR SIGHT DISTANCE AT HIGHWAY INTERCHANGES

DESCRIPTION OF ZONES

1. Grass or low ground cover only
2. Intermittent planting only
3. Tree and shrub planting permissible
4. Tree and shrub planting desirable
5. Shrub planting only permissible and desirable

Source material same as Figure 1.

Figure 4.
SELECTIVE CUTTING ZONES FOR SIGHT DISTANCE AT HIGHWAY INTERCHANGES

SIGHT DISTANCE ZONES SHOWN STIPPLED

MINIMUM DISTANCE OF DITCH AND SHOULDER

DESCRIPTION OF ZONES

1. GRASS OR LOW GROUND COVER ONLY
2. INTERMITTENT PLANTING ONLY
3. TREE AND SHRUB PLANTING PERMISSIBLE
4. TREE AND SHRUB PLANTING DESIRABLE
5. SHRUB PLANTING ONLY PERMISSIBLE AND DESIRABLE

Source material same as Figure 1.

Figure 5.
roads, with their accesses and intersections, are first given only fundamental construction; such refinements as sight distance being added later, as needed. In such cases, the removal of plant material as a safety factor may be a drastic and costly operation. In instances where sight distance requirements may be predetermined, included in the design of the road and specified as part of the construction program, the operation of selective removal of vegetation may be simpler and less costly.

The Blue Ridge and Natchez Trace Parkways, being built by the National Park Service through Virginia, North Carolina, Tennessee, Alabama and Mississippi, have prepared and used Land Use Plans for the development of the roadsides in conjunction with the construction of the roadway. Sight distances on curves and at intersections have been incorporated in the plans for construction and maintenance. Figure 6 is a portion of a Land Use Plan showing the intersection of an access road with the Blue Ridge Parkway. At this particular place, the terrain and the existing access road determined the location of the intersection. The access road crosses the Parkway in the saddle of a ridge at a point that is tangent to the terminus of a tight spiral having a deltacurve of 6 degrees 14.5'. The roadway is 2-lane, with a 20-foot pavement and 5-foot shoulders. It was essential that adequate sight distance be provided both on the curve and at the intersection. It was necessary to
PORTION OF LAND USE PLAN
BLUE RIDGE PARKWAY
(SEE PHOTOGRAPHS 1 AND 2)

Figure 6
remove considerable vegetation in order to achieve this result. All trees and shrubs were removed from the shoulder and shallow fill on the inside of the curve. Remaining vegetation within the sight distance zone was selectively cut, with the cutting being heavy near the roads and progressively lighter back toward the maximum limits of the zone. The transition ranged from a complete clearing along the roadside back to an undisturbed forest. Photograph 1 relates to Figure 6 and shows the condition of this particular intersection before the removal of vegetation to improve sight distance. Photograph 2 illustrates the improvement that has taken place after some of the plant material has been removed.

Sight distance at street intersections in urban areas is another phase of traffic safety on which much can be said that is critical and very little said that is commendable. It can be stated, probably without contradiction, that in every community in the land there are street crossings where trees and shrubs have been planted within the street right-of-way and permitted to grow there until they approach, and perhaps overhang, the curb. At such a crossing, the cautious driver, slowly must creep his vehicle forward to a position beyond the verdant obstruction where he can glance to the right and left down the intersecting street and judge when he may cross or turn. Statistics concerning traffic accidents reveal that a very great number occur at street and highway intersections, where highway
Photograph 1. "Before" selective thinning of vegetation to improve sight distance around curve and at intersection in mountainous area. Blue Ridge Parkway, Virginia.

Photograph 2. "After" selective thinning at same location. This is a closed Vista of a shrub bay.
Many states, counties, and communities have regulations that give control over the type and extent of development that may be permitted within a right-of-way, regulations that describe the extent, for instance to which street and highway intersections must be kept clear and free for greater traffic safety. A proper and timely use of this authority would result in safer driving conditions, improved street and highway appearance, fewer accidents, and a saving in emotional, physical and property values. Too often, however, those in authority are unaware of or indifferent to unfortunate conditions until or unless an incident forces the attention and necessitates a correction. Photograph 5 shows an overgrown planting at a road intersection in a rural area, a "blind" approach that is common everywhere. Photograph 6 shows the same intersection after the offending vegetation had been removed and the area replanted. The improvement for safety is quite apparent.

1/ According to "Special Report 23" seventeen jurisdictions have no statutory provisions relating to the control of vegetation by the State Highway Department; sixteen states have legislation authorizing the State Highway Department to carry on planting operations in the highway right-of-way; twelve
Photograph 3. A badly overgrown corner at an intersection of two highways in a suburban community. The large building partly obscured by shrubbery is a high school.

Photograph 4. A "blind" corner at an intersection of an arterial highway and a city street.
Photograph 5. "Before" selective removal of vegetation to improve sight distance at rural intersection. Maryland State Roads Commission

Photograph 6. "After" selective removal at same location.
states have legislation authorizing the State Highway Department to control planting in the highway right-of-way; two states have legislation specifying that planting in the highway right-of-way shall be subject to consent of abutting owner; six states give the State Highway Department authority in varying degrees to perform planting operations on land abutting the highway right-of-way; thirteen states have legislation permitting the State Highway Department to trim, cut or remove vegetation in the highway right-of-way; twenty-five states have legislation authorizing the State Highway Department to control the trimming, cutting and removal of vegetation in the highway right-of-way by others; six states have legislation providing for the control of noxious vegetation in the right-of-way by the State Highway Department; and four states have legislation authorizing some control of vegetation on land adjacent to the state highway right-of-way.
APPEARANCE

SHOULDERS, DRAINAGEWAYS AND SLOPES

The removal of trees and shrubs from highway shoulders, drainageways and slopes is important for reasons of greater safety, reduced maintenance, improved operation and appearance. It is important for these same reasons when overhead clearance is a consideration, both on tangents and depressed vertical curves.

Road shoulders and drainageways should be kept free of trees and shrubs at all times. Shoulders are intended primarily for the emergency or incidental use of vehicles. The presence of trees and shrubs reduces the area available for this purpose, lessens the value of the shoulder as a safety device, detracts from its appearance and increases the cost of maintenance. (Photo 7) A stabilized turf shoulder is highly desirable if it can be constructed economically. Such a shoulder will support the weight of a vehicle, retard erosion, assist in the drainage of the pavement and roadbed, reduce dust, and give a pleasing green appearance. The presence of trees and shrubs in drainageways could have the following effects: retard the free flow of runoff water and other material and result in a clogged ditch and flooded roadbed; permit greater and uncontrolled percolation under the drainageway and result in saturation and failure of a
road base and fill; increase the cost of repair and maintenance, and present an unsightly appearance. (Photo 8) A sod turf is a highly desirable cover for a drainageway unless the rate and volume of runoff indicate the need for paving material. When paving material is used in a gutter or ditch, it is important that adequate maintenance be provided to prevent vegetation from becoming established in joints or cracks, thus impairing the use and reducing the life of the drainageway.

At the completion of the "heavy" work of a road building project in a rural area, the cut and fill slopes usually are devoid of vegetation unless the presence of an unusual tree or shrub, or groups of them, warrants their preservation, and circumstances are such that the use of retaining walls and tree wells is feasible. If left unmanaged, these slopes would generate a vegetative cover in due course of time. However, the raw material of the slopes, reflecting an unnatural condition created by man, is not conducive to the growth of plant material that is considered desirable or proper for the best development and use of the traffic facility. The species of trees and shrubs that "volunteer" on unmanaged cut and fill slopes frequently are not the same as those present in the undisturbed countryside and may create an unnatural vegetational condition. The rate
Photograph 7. Trees encroaching on a road shoulder that already is narrow.

Photograph 8. Pines that have been growing in a road ditch for a number of years.
of growth is usually rapid and the density of growth often
great. (Photo 9) The character of this "unnatural" volun-
teer vegetation may seem to continue without change indefi-
nitely, when, as a matter of fact, it does modify itself
almost imperceptibly season after season through a long
progression of plant phase changes until eventually it attains
a "climax" and is again in balance with its environmental con-
ditions. When this occurs the vegetation on the cuts and
fills once again will have become a natural part of forest
or field to which it belongs and nature will have reclaimed
its own. To allow nature to continue an undirected and
uninterrupted development on cut and fill slopes is often a
mistake. Eventually the material attains such size and vol-
ume that it offends the principles and requirements of safety
and good appearance. (Photo 10) The offending plants must
be removed, trimmed, or otherwise controlled or managed in
order to re-establish these principles and requirements.
The proper introduction, retention or removal of plants on
cuts and fills should be planned for in a manner that will
achieve a desired effect quickly and keep construction and
maintenance costs low.

In some instances during initial construction of
a road and in the interest of economy, very large trees are
allowed to remain on a constructed slope or close to the edge
of a cut or fill. Environmental changes caused by construction
Photograph 9. Dense growth of young evergreen trees on fill slope will eventually require thinning.

Photograph 10. Young pines on fill slope on curve are reducing sight distance and closing in vista of meadow.
activities may weaken these trees or cause them to die. Such trees constitute a hazard to property and people; where they exist near heavily used roads or public use areas they should be removed. The post construction removal of such trees is usually more costly than would have been the cost during initial construction of the road. Very often a potentially dangerous tree is not removed until wind, storm or other action has sent it crashing down across a road, perhaps damaging slopes, ditches, shoulders and pavement and obstructing, as well as endangering traffic. (Photos 11 and 12)

For the most part, it is highly desirable that cut and fill slopes be planted to prevent erosion and improve appearance. The planting areas are usually defined by the somewhat regular line of vegetation that remains at the top of a cut or the toe of a slope as a result of construction operations. The retention or introduction of plant materials within these zones should be governed to some extent by the requirements for sight distance and the need to blend the slopes with the adjacent roadside. Close to the road itself, where sight distance is an important consideration, all plant materials within the sight distance zone should be kept below the eye level of the car operator or should be so dispersed or sufficiently high-headed that the vision is not obstructed. Where cut and fill slopes occur in an unbroken forested area, the size and density of vegetation on the slopes may become
Photograph 11. Wind-thrown sequoia that fell across road has been cut up and moved to one side pending further disposal. Sequoia National Park, California

Photograph 12. Sequoia thrown by eroding slope caused considerable road damage. Later, pulled and slid downslope to become part of forest floor. Sequoia National Park, California
progressively greater as the distance from the roadway increases. Where shrub bays or woodland meadows occur in forested areas, the use of trees and shrubs on cuts and fills should be planned so that the slopes become a part of the openings in the forest. Very often this necessitates the removal of vegetation in a transition zone at the toe of a fill or the top of a cut in order to produce a softer outline of these zones and to effect a change from roadside to forest bay or meadow in a manner that is not abrupt but is gradual and pleasant.
OUTDOOR ADVERTISING

One factor that has had a great and nationwide effect upon the appearance of roadsides is the business of outdoor advertising. Anyone who has traveled by automobile has been freely advised, cajoled or admonished concerning the products of the nation's commerce and industry by the multitude of billboards - infinitely varied, sized and shaped - that flank the roadside at locations most advantageous for their display.

These signs are located usually just outside the right of way limits of a road. Their presence is authorized, in most instances, by permit issued by a proper State agency. Their location along a right of way is determined, in part, by the display advantages of a particular site, by permission granted by the property owner of a selected site and by any special regulations in effect by State or municipal organizations to regulate the use and location of outdoor advertising devices. As an example of this latter control, the Commonwealth of Virginia has a regulation that says "No advertisement or advertising structure shall be erected, maintained, or operated:

(1) Within 500 feet of the Blue Ridge Parkway, Colonial Parkway, Mount Vernon Memorial Highway or within 500 feet of any public
cemetery, public park, public playground, reservation, national or State forest, outside the limits of any municipality;--"1/.

The same Regulation describes other conditions relating to road intersections, curves, railroad crossing, and sight distance affecting the use of billboards and other outdoor advertising devices.

Permission to erect and maintain an advertising structure does not carry with it a guarantee that the structure will always be in clear sight from the highway. There are usually some restrictions governing the erection of signs on private property at particular locations, and there are generally always State or municipal regulations concerning the cutting and trimming of trees and shrubs within highway rights of way. The erection of an advertising sign and the likelihood of its becoming obscured one day by growing vegetation is the risk of the outdoor advertiser. No sign should be placed without regard to existing regulations with the expectation that when the need arises for clearing for sight view permission for such clearing will be granted automatically by the designated authorities. In cases where clearing is desired and permission to clear is granted, the cost of the operation of selectively or completely removing trees and shrubs affecting the sight view should be, and usually is, arranged for by the advertiser and the performance of the work
is under the supervision of the landscape engineer or landscape architect of the responsible highway authority.

Where such structures already exist, the size and shape of the area from which vegetation is to be cut and removed, and the size and kind of material affected, should be determined from the relative merits and circumstances of each case. Where a billboard is placed on the top of a cut at the terminus of a tangent, very little cutting of foreground vegetation may be required. Where a billboard is placed on the outside of a curve or on a tangent on a wide right of way and at nearly eye level, then a considerable cutting of foreground vegetation on the approach side of the sign may be required. Other factors affecting the amount and extent of the cutting desired and the type and frequency of subsequent maintenance required are the characteristics of the plant materials themselves -- the rate of growth, ultimate size, density, habit of growth, tendency to sucker, etc.

Some State highway authorities are cognizant of the roadside development problems engendered by the business of outdoor advertising and have established regulations and standards controlling the location, use and maintenance of outdoor advertising structures and their environs. The North Carolina State Highway and Public Works Commission, for example, has adopted, on a trial basis, a policy and program of roadside development and has devised a set of regulations and standards.
to fit that policy and program to outdoor advertising. The standards include a plan suggesting locations for outdoor signs and giving dimensions of tree and shrub areas to be cleared and maintained. That plan is reproduced as Figure 7 for the purposes of this report. 2/

Footnotes
1/ "Laws of Virginia Relating to Outdoor Advertising."
Reprint from the Code of Virginia 1950 and the 1956 Cumulative Supplement (1956)

Figure 7

Drawn from STANDARDS FOR ROADSIDE VEGETATION AND OUTDOOR ADVERTISING prepared by NORTH CAROLINA STATE HIGHWAY AND...
UTILITY LINES

There are occasions when it is necessary to remove or to trim trees and shrubs along a roadside in order to permit the unhindered passage of telephone, light and power lines. Evidence of line clearing work is discernible along older roads where vegetation has grown large through the years and it has become necessary to make a way for the utility wires through the foliage. In the hands of experts, the required pruning, trimming or removal of plants for utility purposes may be done so skillfully that the altered appearance of the plants is not unnatural and is scarcely noticed. Done by the novice or the careless, the results may be grotesque. (Photo 13)

It has been a practice in some areas (the national parks, for instance) to carry utility lines underground as much as possible, at least in those locations where they cross a road. Where underground installations are not feasible and the lines are carried overhead, the crossing of a road is usually made at right angles to the road with the poles or towers as far apart as practicable; thus the traveler is aware of the presence of the lines for as short a space of time as possible.
In all instances where a utility line is located close to a road, either paralleling it or crossing it, overhead or underground, the removal or thinning of trees and shrubs within the easement of a utility line can follow a definite and desirable pattern. Only enough vegetation should be removed near the center of the easement to permit the free and clear passage of the lines and the progress of maintenance personnel and equipment. This passageway from pole to pole or tower to tower is not necessarily a straight line, it may be somewhat indirect because of topography and ease of access. Clearing operations, particularly on slopes, should be conducted in a manner that will avoid erosion. It is desirable to maintain a low ground cover over the entire central area of clearing. From this area outwardly to the limit of the easement, the selective removal of trees and shrubs should be progressively less, so that a transition is developed from the heavy clearing in the center to the limited clearing at the edge. All trees that could foul the conductors in falling should be removed. Maintenance should be provided on a 3 to 4 year interval. Trees and shrubs that are not expected to reach a dangerous height within this period need not be removed. (Figure 8) 

Photograph 13. An example of what should not be done in tree trimming for line clearance.
TRANSMISSION LINE ROW CLEARING FOR OPERATION & MAINTENANCE

TREE TO BE REMOVED

FOLIAGE LINE BEFORE CLEARING

LIMIT OF ROW OR EASEMENT

Sketched from PUBLIC GROUNDS MAINTENANCE HANDBOOK, TENNESSEE VALLEY AUTHORITY, JUNE 1953

Figure 8
Today's highway is more than just a facility designed to move cars, commerce and people quickly from one place to another. It has other purposes. It endeavors to make that trip from here to there as safe, as restful, as diversified and as interesting as possible. It encourages the motorist to use the road for reasons other than simply travel by adding such features as parking turnouts, rest areas and wayside parks. It calls attention to historic events and natural or other phenomena by means of wayside signs, exhibits or museums. It develops interest in its alignment by merging with the forest and deserts blending with the meadows and fields, and creating vistas to points or areas of special attraction.

Wherever and whenever the characteristics of a roadside indicate the desirability of constructing special devices or creating special effects, the treatment of plant materials becomes an important consideration.

A parking turnout, essentially an extension of a traffic surface, may simply provide the driver of a car or
truck a place to rest and relax for a time. It may or may not be separated from the primary trafficway by an island or median. If there is such a separation and it is to be planted, the plants should be limited to the low-growing, ground cover variety, for reasons of sight distance and protective surveillance. If a turnout has been development under circumstances that permit the use of an island and the retention of some existing trees and shrubs in that island, the existing vegetation should be thinned sufficiently to embody the best principles of sight distance appearance and use. A turnout intended to provide parking alongside a sign, marker, interpretive device or other structure should be given the benefit of deliberate planting design. The setting provided should present the area to its best advantage. If the plant materials already exist, enough plants should be removed so that attention is directed to the center of interest of the area and at the same time have the area "tie in" with its surroundings. Very often a turnout provides parking at an area of special interest or an outstanding vista. The special interest of such an area may be a nearby relatively narrow view of a waterfall, rock ledge, or shrub bay; or it may be a distant, sweeping panorama of a mountain, lake or valley. The landscape and planting design of each subject should be determined according to its own requirements. It may mean the selective removal of relatively few plants within a confined space or the almost mass removal of many plants over a large area.
Rest areas and wayside parks adjacent to a roadside not only provide parking space for vehicles but facilities for general public use of the area, such as water, tables, benches, fireplaces, toilets, walks, and so forth. Such areas and parks usually are located where they will offer the most benefits to the traveler. They are often a number of miles from populated areas, on sites that are not larger than a few acres in size, where ample shade and water are available and where scenic quality or other features are worthy of development and conservation. The site development of each area or park should be considered according to its own merits. If some clearing of the site is required, enough plants should be removed so that a somewhat "open" aspect is achieved, thus making simpler the problems of administration, protection and maintenance. If clearing is desired to open a fine view, periodic pruning and selective thinning may be necessary in order to maintain that view.

Whenever and wherever circumstances warrant the removal of trees and shrubs to create vistas of distant scenes or views of a closer, more special nature, along a roadside or at a roadside public-use area, the degree of artificial management or control of vegetation required seems to follow certain prescribed conditions and patterns.
For the sake of brevity, the creation of any roadside picture or composition through the removal of vegetation may be called a "vista," regardless of its size or other circumstances.

Vistas are developed with two points of view in mind. They may be the "stationary" kind - the kind seen from a parked car or from the described limits of a parking turnout, rest area or wayside park; or they may be the "moving" kind - the kind seen from the windows of a vehicle still moving forward on the highway.

The extent of vegetative clearing to be done for either a stationary or moving vista depends to some degree upon the consideration of a "time-space" relationship that exists between the scene or object to be viewed and the person doing the viewing. If a vista is created at a stationary location, the element of time is less important than space. The observer is not concerned with brevity of time, but is interested in the characteristics of the vista. He may exercise an option of remaining stationary (in a parked car) or becoming ambulatory (in a delimited area). The view provided may be singular in number and narrow in extent, necessitating the removal of relatively few trees and shrubs; or the views may be many in number and varied in extent requiring considerable clearing, depending upon the movements of the observer. Generally,
the clearing required for a stationary vista is quite selective and conservative because the observer has more time to see and to study the scenes or objects called to his attention. If a vista is created at a moving location, the amount of time and space planned for should relate directly to the vehicle operator's viewpoint. This is important for safety reasons. It is not uncommon to receive reports of automobile accidents caused by the momentary diverting of a driver's attention to a scenic attraction or object along the roadside. Very often, the underlying causes of such accidents are improper sites and overextensive clearing for such vistas. No moving vista should be located on a curve, at the end of a tangent leading into a curve, or at right angles to tangents. In negotiating curves, the vehicle should command the driver's full attention. On tangents, the driver's vision should be concentrated forward within a maximum angle of 45 degrees and preferably only 30 degrees, from the direction of travel. At a speed of 35 miles per hour a car moves approximately 50 feet, at 60 miles per hour about 90 feet. The extent of selective cutting provided for a moving vista at an angle should allow for the fraction of a second required to bring a driver's attention to the vista and for a few seconds to view it.
The subject of the vista should be relatively simple so that the observer, catching a glimpse of something rare and unusual within the frame of the foliage, may remember pleasure from the "flash" picture long after he has moved past it. Clearing for such vistas never need be more than a few hundred feet in length. If the subject of the vista is somewhat continuous in nature and extensive in length, then several "flash" pictures may be provided at intervals within the same vista area. If the nature of the vista suggests that it should be cleared for more than several hundred continuous feet of its length, then it has passed beyond consideration as a moving vista and should be considered a stationary vista, with a parking turnout or other stopping place provided. (Figs. 9 and 10) (Photos 14 and 15)

In addition to considerations described above, clearing for vistas depends to some extent upon the nature of existing vegetation and the direction of prevailing winds. From the position of forest protection, the cutting of vistas should be undertaken with great care. The susceptibility of trees to windthrowing varies considerably with the species of tree, the age and condition of the forest stand, and with topographic and other site conditions. Trees growing in a closed stand may be destroyed if an opening made in the stand exposes some
EXISTING POTENTIAL VISTA
OF VALLEY OR LAKE, ETC.
FROM HIGHWAY

WRONG
MOVING VISTA AT 90° ANGLE.
FROM HIGHWAY IS HAZARDOUS

RIGHT
MOVING VISTA AT NOT TOO WIDE
AN ANGLE FROM DIRECTION OF TRAVEL

RIGHT
STATIONARY VISTA AT WIDE ANGLE
WITH PARKING TURNOUT PROVIDED

Figure 9
**RIGHT.** VISTA AT NOT TOO WIDE ANGLE FROM DIRECTION OF TRAVEL

**WRONG.** VISTA FROM CURVE APPROACH AND ON CURVE IS HAZARDOUS

**WRONG.** VISTA FROM CURVE APPROACH (WARNING SIGN ZONE) AND ON CURVE IS HAZARDOUS

**WRONG.** VISTA AT 90° ANGLE FROM HIGHWAY IS HAZARDOUS

**RIGHT.** VISTA COMPLETED BEFORE PASSING WARNING SIGN ON CURVE APPROACH

Figure 10
Photograph 14. Open Vista offering "flash" picture. Minor criticism may be that it is too near end of tangent approaching a curve. Glacier National Park, Montana.

Photograph 15. Portion of Open Vista of considerable extent. Parking turnout, sidewalk and guardwall have been provided. Shenandoah National Park, Virginia.
of the trees to wind action. Selective cutting should be planned so that vista openings will not expose unstable trees, particularly at the ends of long clearings. The shaping of vistas that will give the effect of a wind tunnel should be avoided. As often as possible, clearing for vistas should be done at right angles to the direction of the prevailing wind in order to reduce the possibility of windthrown trees. (Fig. 11) (Photos 16 and 17)

The manner of selectively removing vegetation for vistas appears to result in three general types of vistas, insofar as a pattern of clearing is concerned. These types may be considered to be open, closed and canopy vistas.

An open vista is one where the vision extends, generally without interruption to the horizon and to the lateral, or right and left, limits of a clearing. It usually favors a panorama of some distant scene, such as a valley, mountain, lake, or open countryside. In some instances, roads may be intentionally located and constructed for the express purpose of bringing an interesting subject to the attention of a traveler. If the preconceived inclusion of this subject in the design of the road calls for an open vista, it may be "built in" during initial construction as a factor of clearing operations. Open vistas also may occur as a secondary result of construction, caused either by road
WINDTHROW

TREES GROWING IN EXPOSED LOCATIONS ARE ADAPTED TO STRONG WINDS. THEY SHOULD NOT BE REMOVED IF THEY FORM A BUFFER AREA PROTECTING TREES THAT ARE LESS STABLE.

SUSCEPTIBILITY TO WINDTHROW VARIES ACCORDING TO SPECIES OF TREE (MANY CONIFERS ARE SHALLOW-ROOTED), AGE AND CONDITION OF STAND OF TREES, AND TOPOGRAPHIC AND OTHER SITE FACTORS.

RIGHT. VISTA AT NEARLY 90° ANGLE TO STRONG WINDS

HILL

TREES SUSCEPTIBLE TO WINDTHROW

TURNOUT

ESTABLISHED TREES ADAPTED TO STRONG WIND EXPOSURE

WRONG. TREES EXPOSED ON HILL MAY BE UPROOTED BY STRONG WINDS

WRONG. STRONG WINDS THRU FUNNEL CREATED BY VISTA MAY TOPPLE TREES ACROSS HIGHWAY

EXISTING POTENTIAL VISTA OF VALLEY, LAKE, ETC.

PREVAILING DIRECTION OF STRONG WINDS

Figure II
Photograph 16. "Before" selective cutting for angled "flash" vista along Merced River, Yosemite National Park, California

Photograph 17. "After" selective cutting had been completed at the above site.
location through open areas or by large fills that permit an unobstructed view over the adjacent landscape. Where desirable and proper open vistas may be created by selective cutting, an operation usually requiring a rather complete and extensive removal of trees and shrubs. (Photos 18 and 19)

A closed vista is one where the vision is restricted, or confined, to a generally small area by a vegetative barrier. Such a vista may afford an intimate and singular glimpse of a specific scenic attraction or other natural phenomenon, an historic structure, perhaps or a stand of shrubs, a waterfall or a rock formation. Closed vistas usually are relatively small in size and only moderately cleared. They may exist or be created with considerable frequency along a roadside. Although objects or areas worthy of development as closed vistas often occur near a roadside in great variety, their potential interest often is overlooked and neglected. Closed vistas usually are created and the selective cutting and cleanup required for their development must be done very carefully and with much imagination. (Photos 1 and 2)

A canopy vista may be either an open or closed vista that is framed overhead by trees close to the road or the observer. The line of vision is through and under the trees and may be extended or constricted as circumstances
Photograph 16. Site of an Open Vista "before" selective cutting to open up the view.
Bridalveil Fall, Yosemite National Park, California

Photograph 19. An "after" view of the same Open Vista.
indicate. Often the more attractive and less expensive of the vistas, it should be given special consideration. At the site of a canopy vista, the understory of shrubs and small trees should be removed and the remaining stand of trees should be thinned or pruned. The trees that are left should form a canopy, moderately highheaded, that will enable one to look under and through the trees to the vista's subject of interest. The removal of vegetation should not be too thorough and the cutting should be carefully studied to determine how a transition may be developed from the center to the limits of clearing and what plant material should be retained. (Photos 20 and 21)

1/ Footnote

Photograph 20. Site of a Canopy Vista "before" selective cutting of trees and shrubs. Skyline Drive, Shenandoah National Park, Virginia

Photograph 21. An "after" picture of the same Canopy Vista.
CONSTRUCTION AND MAINTENANCE

Considerable care and judgment must be exercised in the actual physical phases of removed trees and shrubs during construction and maintenance operations. The work to be done should be given the benefit of the professional knowledge and experience of such persons as the Highway Engineer, Landscape Architect, Forester, Agronomist, Naturalist and others. There should be close communication and cooperation between all professionals, and the interests of each one should be blended with those of each other for the success of a project as a whole.

It is easy to remove vegetation. It is difficult and costly to replace plants when their removal has been made in error, or has resulted in a condition requiring correction beyond the intended purposes of the clearing. For instance, the development of a site for an open vista could create conditions that would cause land erosion and plant damage through lack of consideration of such factors as degree of slope, type of soil, amount of moisture, type of drainage, and exposure to sun and wind. The analysis of these and other factors by qualified persons prior to or during early stages of road
construction and roadside development could result in a modification or the elimination of a proposed clearing project.

As often as possible, the removal of vegetation for roadside vistas and other purposes should occur with the construction of a road. Roadside development aims and needs should be studied and plans prepared beforehand, if at all practicable. Such plans not only could specify the work to be done during construction but could set the pattern to be followed later by maintenance. Land Use Plans prepared for the 477-mile long Blue Ridge Parkway and the 450-mile long Natchez Trace Parkway, being built for the National Park Service through Virginia, North Carolina, Tennessee, Alabama and Mississippi, have been in continuous use ever since the first construction contract was let in 1935. A portion of one of these land use maps has been reproduced for the purposes of this report. (Fig. 12)

Much of the time, circumstances do not permit roadside development until a road has been completed and in use. At this stage, clearing operations usually are more costly than during the stage of initial construction of a road. However, to offset this higher cost factor, two advantages may be drawn: there is time to observe and analyze roadside development needs according to actual driver and passenger use of the road, and there is time to prepare for the work to be done, thus minimizing
the hazard of an error of judgment in planning.

After a clearing project has been completed, it becomes an item of maintenance. At every site where vegetation has been removed, for whatever purpose, some maintenance must be performed periodically in order to retain the result accomplished and the effect desired. Nature is not static. New plants volunteer quickly and grow rapidly and profusely in artificially favorable conditions created by construction. Plants remaining after selective thinning tend to become more leafy and larger because of more sunlight and less competition. Without adequate maintenance, road shoulders, ditches and slopes quickly could become overgrown. Framed vistas could have their pictures "painted out" by a hedge of seedling trees and shrubs. Many a traveler has been more than mildly annoyed because the only view from a road or from a parking overlook has been a "picket fence" of tree trunks. (Photos 22 and 23)

The importance of maintenance in roadside development has been recognized for some time by a number of State highway departments and other highway authorities and commissions. The problem of how to describe and accomplish required maintenance work within rights of way has been approached in a number of ways by various highway agencies. The Department of Public Works, State of New York, and the State Highway Department, State of New Jersey, for example, prepare sets
Photograph 22. Hedge of young trees obscuring view from parking area on Skyline Drive, Shenandoah National Park, Virginia

Photograph 23. View from same parking area after selective cutting of vegetation.
**DRAWN FROM STANDARDS FOR ROADSIDE VEGETATION AND ENCROACHMENTS prepared by NORTH CAROLINA STATE HIGHWAY AN. PUBLIC WORKS COMMISSION, MAY 1955**

**Figure 13**

- **60' ROW**
  - No new trees to be planted on ROW
  - Existing trees may remain unless a hazard
  - 30'

- **150' ROW**
  - Tree Area
  - 18' 20' 12'
  - Only low-growing plants if utility line exists
  - 9'
  - Maximum utility clearing area
  - Low-growing plants to be preserved
  - Maximum fence or cultivation encroachment pending dual constr.
  - 60'
  - Vegetation in this area to be preserved until dual constr.
  - 60'

- **150' ROW (Dual Pavement)**
  - Only low-growing plants if utility line exists
  - 15'

- **200' ROW**
  - Tree Area
  - 15'
  - Vegetation in this area to be preserved until dual constr.
  - 60'
  - 60'
  - 60'
  - Maximum utility clearing area
  - Low-growing plants to be preserved
  - Maximum fence or cultivation encroachment pending dual constr.
  - 60'

- **250' ROW**
  - Also applicable to a 250' ROW
  - Maximum utility clearing area
  - Preservation of low-growing plants optional
  - 15`
  - Vegetation in this area to be preserved until dual constr.
  - 60'

- **10' ROW**
  - No fence or cultivation encroachment on special highway
  - 10'
of construction drawings and specifications, advertise for competitive bids and award contracts for roadside development projects. The North Carolina State Highway and Public Works Commission, as another example, modifies a set of regulations and a plan of standards (Fig. 13) to fit roadside conditions and performs the necessary work with its own construction forces. The National Park Service may use sets of specifications and Land Use Plans, and have the work accomplished either by contract, by force account, or by "special use" permit. A special use permit is a document, often with a plan attached, issued by the Service to individuals, permitting owners of property adjacent to a roadside to use portions of the right of way for conforming agricultural or other specified purposes according to certain regulations. It enables the Service to perpetuate the special character of a roadside at certain locations - perhaps an existing vista, a forest, an orchard or cultivated fields, and farm buildings. It usually requires the permittee to perform ordinary maintenance at his own expense, subject to supervision by the Service.

Several years ago, the National Park Service began a study of road maintenance factors to determine whether or not a "typical" plan could be drawn that would reflect existing conditions and maintenance requirements of both a road and a roadside. Special attention was given to the roadside development phase of the problem, using parkway land use plans as a
pattern. A "sample" vista clearing project was initiated in each of the then four Regions of the Service; in Shenandoah National Park, Virginia, in Glacier National Park, Montana, in Zion National Park, Utah, and in Yosemite National Park, California. The study has not been completed and no definite conclusions have been reached. A portion of one of the proposed maintenance plans has been reproduced and is included in this report (Fig. 14). A number of sets of "before and after" photographs of vista clearing operations also are included. (See photos 16 thru 23).
SELECTIVE CUTTING PRACTICES

The practice of selective cutting of roadside vegetation seems, by consenus, to reflect the adage that "an ounce of prevention is worth a pound of cure."

At sites where extensive clearing is to be done, it has been determined, by inquiry, that it is considered to be better to remove vegetation progressively, in two or three operations extending over several years, than to clear away all of it in one operation. This more cautious procedure permits time for a study of contingent factors (soil, slope, moisture, etc.) and a gradual development of a desired effect with less danger of error. Usually, all low plants such as weeds, vines, low shrubs and seedling trees are cut by brushhook, axe or sickle and the slash removed as a first operation. The cut stumps of perennial plants that could regenerate by suckering are then sprayed with an herbicide. Care should be taken so that the spraying is selective rather than general. A first cutting of this nature helps to define the limits of clearing, facilitate the movement of men and equipment in the area, and determine where, how much and what kind of additional material still should be removed. At a second selective cutting
operation during the same season, in another season, or another year, all plants that have seeded or suckered after the first cutting should be cut, removed and the stumps sprayed. Larger trees may then be cut according to pattern by axe, handsaw or powersaw, large limbs and trunks removed and the cut stumps sprayed. Smaller limbs and slash may be reduced in size, either manually or mechanically, and the reduced material broadcast over the area as a mulch to retain moisture and retard erosion. If a third cutting is required, the removal and disposal of trees and other material should follow the same practice as for the second cutting, except that this time the project should be completed and the desired effect achieved. It should then be possible to retain this effect with routine maintenance performed every two or three years. If the effect achieved is that of a roadside meadow or bay, it may be necessary to mow the area two or three times each year. Two cuttings a year will keep woody plants low and will allow grass and wildflowers to grow in the meadow or bay.

At some sites, extensive clearing was accomplished as a part of the initial construction of a road (on cut and fill slopes, road shoulders and ditches). At such sites, the planned development may require that some regeneration of plants be permitted for a period of time (such as on cut and fill slopes) before the selective thinning of this material may be done as
a maintenance operation. On road shoulders composed of granular material, undesirable plant growth may be removed by grubbing, mowing or spraying. Turf shoulders may be maintained by mowing as many times during a growing season as conditions warrant. In ditches, volunteer plant growth may be removed by grubbing or spraying.

The size and composition of a crew organized to do selective cutting of trees and shrubs, and the kinds and types of material and equipment needed to perform the work most effectively, vary considerably. Crews and equipment are sometimes determined by the nature of the terrain and the size and amount of the plants to be removed, both of which have an effect upon the amount of manpower or machinepower that can be used.

For one contract in the State of New York it was observed that the most effective crew consisted of a foreman who also did the spraying of the stumps, three pairs of chain saw operators and two laborers who kept several wood fires burning. For several contracts, the felled trees were cut into four-foot fireplace lengths and hauled away free by wood dealers, thus eliminating the necessity of burning the wood.

The crews working on two force account vista clearing projects on the Blue Ridge Parkway, Virginia, consisted of nine men each; a maintenance foreman, one back-pack spray operator, two chain saw operators and five laborers.
At another site, where routine maintenance was being provided for an area that had been cleared two years earlier, the crew consisted of a foreman who was also the spray operator, one man using a brushhook, and two laborers.

For a selective thinning contract in New Jersey, a contractor used a wood chipper to reduce brush, limbs and small trees to a size that would make the material valuable as a mulch.

Force account selective cutting operations in North Carolina reveal by experience that a crew foreman cannot properly select plants with six or seven men cutting, nor can four or five selectors (no matter how experienced) work in one location effectively. It is preferred that a crew consist of a foreman, one or two selectors, a chain saw operator, a chemical spray operator, a wood chipper operator, and laborers as needed to cut weeds, briers and non-woody brush and to feed the chipper.
COSTS

The cost in dollars of the work of selective cutting derives from certain fundamental sources, i.e., the unit costs of items of work. However, the compiled total cost of work to be done is not always expressed in terms of a unit of measure that is common to all highway departments, commissions, authorities or other highway agencies.

These units of measure may be miles of length, acres, number of sites, or units of work. Information received from North Carolina indicates that the force account cost of selective cutting varied from $50 to $300 per mile; that contract costs in New York varied from $200 to $600 per acre; that contract costs in 1955 in New Jersey were a minimum of $325 per acre and a maximum $360 per acre. Examination of a number of contracts for vista clearing (1952) on the Blue Ridge Parkway on a cost per site basis reveals the following: in Virginia, 43 sites were cleared at a cost of $15 per site, 66 sites at a cost of $25 per site; in North Carolina, 70 sites were cleared at a cost of $40 per site. In Zion National Park, Utah, vista clearing by force account cost $10 per tree for 250 mature trees and $5 per small tree or shrubs for 450 such
plants. Mount Rainier National Park, Washington, reported an estimate of $50 per tree for 70 trees at four separate sites. In Sequoia National Park, California, the cost of removing one sequoia felled by an eroding slope was $500 (Photo 12). In Great Smoky Mountains National Park, Tennessee portion, through Special Use Permits, conforming land use and vistas were perpetuated on 1,239 roadside acres at no cost to the government.

There is considerable latitude in the range of unit costs of the various items of work that constitute a selective cutting project. These costs are affected by many factors: size of the project; amount and size of plant materials to be removed and the manner of disposal; proximity of project to sources of labor, materials and equipment; local labor rates and availability of labor, materials and equipment; tolerance of specifications and supervision; to name a few. Sometimes the project is part of a general contract and the lowest bid quoted for selective cutting is not necessarily the one for which a contract is awarded.

The following tabulation, incomplete and not necessarily comprehensive, country-wide, reflects the wide variation in unit costs for many items of work:
## Selective Cutting Costs

<table>
<thead>
<tr>
<th>Work Item</th>
<th>Unit</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brush cutting, by hand</td>
<td>acre</td>
<td>$25-150</td>
</tr>
<tr>
<td></td>
<td>mile</td>
<td>$40- 50</td>
</tr>
<tr>
<td>Brush cutting, by machine</td>
<td>acre</td>
<td>$10- 25</td>
</tr>
<tr>
<td>Chemical spraying 2/ contact</td>
<td>acre</td>
<td>$300-600</td>
</tr>
<tr>
<td>translocation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st year, 75% control</td>
<td>acre</td>
<td>$75-150</td>
</tr>
<tr>
<td>2nd year, 95% control</td>
<td>acre</td>
<td>$75-150</td>
</tr>
<tr>
<td>Retreatment, if necessary</td>
<td>acre</td>
<td>$10- 15</td>
</tr>
<tr>
<td>Mowing grass</td>
<td>acre</td>
<td>$10- 20</td>
</tr>
<tr>
<td>Selective cutting of existing trees and shrubs 3/</td>
<td>acre</td>
<td>$30-600</td>
</tr>
<tr>
<td></td>
<td>mile</td>
<td>$50-300</td>
</tr>
<tr>
<td>Trimming existing trees, 6 inch caliper each</td>
<td></td>
<td>$5- 10</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>$10- 15</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>$15- 20</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>$20- 30</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>$30- 40</td>
</tr>
<tr>
<td>Tree removal 6-12 inch caliper</td>
<td></td>
<td>$20- 30</td>
</tr>
<tr>
<td></td>
<td>12-18</td>
<td>$30- 50</td>
</tr>
<tr>
<td></td>
<td>18-24</td>
<td>$50- 70</td>
</tr>
<tr>
<td></td>
<td>24-30</td>
<td>$70- 90</td>
</tr>
<tr>
<td></td>
<td>30-36</td>
<td>$90-130</td>
</tr>
</tbody>
</table>

1/ Limited to cut and fill dimensions of road prism.

2/ "Roadside Vegetative Cover, Research Project."

March 1954, Landscape Bureau, Department of Public Works.
Maryland, 1955  Light clearing  acre  $150-200
  Medium    "     "     $250-300
  Heavy     "     "     $350-500

New York, 1952-53    "     "     $200-600
New Jersey, 1955    "     "     $325-360
North Carolina, 1956  mile  $50-300
Virginia, 1952, Blue Ridge  acre  $30-61
  Parkway (Does not include cost
  of professional supervision)

In the tabulation of selective cutting costs, attention is directed to footnote 3/ of the work item "Selective cutting of trees and shrubs."

In October 1952, the National Park Service set up two demonstration vista clearing projects on section 1-K, Blue Ridge Parkway, Virginia; one an Open Vista and the other a Canopy Vista.

The two sites were studied beforehand and a drawing showing the limits of the proposed work prepared for each site. (Figures 15 and 16). A crew was organized and materials and equipment collected. Beginning in the morning and operating at a normal pace under close supervision of a landscape architect and a highway engineer, the vista clearing for the two sites was begun and completed in two days. The weather was clear and cool, the elevation about 2,500 feet. The average age of the crewmen was about 35 and each man was experienced in the use of wood cutting tools and equipment.
Figure 16

VISTA CLEARING PLAN
CANOPY VISTA - SECTION 1-K - STA. 433-437
BLUE RIDGE PARKWAY
VIRGINIA

DRAWN FROM:

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DRAWN BY DISQUE

Jefferson National Forest

SCALE
100' 200' 300'
The site of the Open Vista was partly on a 40-foot high, 15-year-old fill on which no previous vista clearing had been performed and partly in an existing grove of trees that had not been thinned. Much of the vegetation on the fill consisted of patches of briers, clumps of sumac, small sassafras and locust, and a number of paulownia that had reached a caliper of 12 inches. Most of the cut material was reduced in size and allowed to remain on the slope as a mulch, the remainder was pulled beyond the limits of clearing and allowed to remain as part of the forest floor. The selective removal of vegetation in the grove of trees consisted of mixed hardwoods up to 12 inches in caliper. This cut material was pulled beyond the limits of clearing and allowed to remain.

The site of the Canopy Vista was a moderate downslope in a dense grove of mixed hardwoods and pines that had not been thinned previously. Most of the trees removed were hardwoods having an average caliper of 8 inches, although several trees were 18 inches in caliper. Most of the cut material was permitted to remain beyond the limits of clearing, the larger tree trunks were cut to 8-foot lengths and removed by truck.

A tabulated resume of labor, time, equipment and cost factors follows:

Open Vista: Stations 495-505, 1.38 acres open, 0.23 acres woods

<p>| Maintenance foreman | 4.5 hours | @ $2.00 | $9.00 |</p>
<table>
<thead>
<tr>
<th>Description</th>
<th>Hours</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laborers - 5 men</td>
<td>4.5</td>
<td>.80</td>
<td>$18.00</td>
</tr>
<tr>
<td>2 men</td>
<td>4.5</td>
<td>.85</td>
<td>7.65</td>
</tr>
<tr>
<td>1 man</td>
<td>4.5</td>
<td>.90</td>
<td>4.05</td>
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<tr>
<td>Equipment rental and amortization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 pickup trucks 50 miles</td>
<td></td>
<td>.07</td>
<td>3.50</td>
</tr>
<tr>
<td>Overhead - chain saw and 2,4,5-T spray</td>
<td></td>
<td></td>
<td>5.80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$48.00</strong></td>
</tr>
</tbody>
</table>

**Canopy Vista; Stations 433-437, 1.00 acres**

<table>
<thead>
<tr>
<th>Description</th>
<th>Hours</th>
<th>Rate</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance foreman</td>
<td>6</td>
<td>2.00</td>
<td>$12.00</td>
</tr>
<tr>
<td>Laborers - 5 men</td>
<td>6</td>
<td>.80</td>
<td>24.00</td>
</tr>
<tr>
<td>2 men</td>
<td>6</td>
<td>.85</td>
<td>10.20</td>
</tr>
<tr>
<td>1 man</td>
<td>6</td>
<td>.90</td>
<td>5.40</td>
</tr>
<tr>
<td>Equipment rental and amortization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 pickup trucks 50 miles</td>
<td></td>
<td>.07</td>
<td>3.50</td>
</tr>
<tr>
<td>Overhead - chain saw and spray</td>
<td></td>
<td></td>
<td>5.90</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$61.00</strong></td>
</tr>
</tbody>
</table>
CONCLUSION

The information contained in this report is incomplete - necessarily, it would seem. In years past, some selective cutting and maintenance projects have not had the good fortune of complete management. Some of the history has not been recorded, statistically or graphically, and this omission cannot be corrected. In this respect, there always will be gaps in the record. For some projects there are complete and valuable records. Other projects are in an active status and data concerning progress will become available from time to time. Information that portrays the "before, during and after" status of present selective cutting construction and maintenance operations will be of high value in providing a basis for the development of criteria, costs and methods of procedure for future projects. In light of a growing awareness of the importance of the subject of roadside development in an expanding highway program, this report marks a showing of interest and information in one phase of the general subject - the selective cutting of roadside vegetation for improved highway safety, appearance and use.