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SPECIAL REPORT 88

*the ART and
SCIENCE of*
ROADSIDE DEVELOPMENT

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SPECIAL REPORT 88

NAS-NRC Publication 1329

the ART and SCIENCE of

ROADSIDE DEVELOPMENT

A SUMMARY OF CURRENT KNOWLEDGE

Subject Classification

- 24 Roadside Development**
- 40 Maintenance, General**
- 70 Legal Studies**

NRC, HIGHWAY RESEARCH BOARD

" X of the

Division of Engineering and Industrial Research
National Academy of Sciences–National Research Council
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FOREWORD

BOTH the general public and those charged with building and maintaining our Nation's highways have become increasingly aware of the importance of roadside development as an integral part of any truly progressive highway program and as a major step in the preservation of a precious American heritage—scenic beauty.

With this increased awareness has come an immediate need for a reference document that defines, outlines, and discusses our present degree of knowledge concerning the many varied and diverse subject areas that comprise the broader concept of roadside development.

The Highway Research Board's 25-year-old Committee on Roadside Development responded to this need earlier this year by bringing together the considerable talents of its members, each of whom is preeminent in the several fields comprising roadside development.

This publication is the result of the efforts of these professionals to compile a brief, but meaningful, publication that describes and places in perspective virtually every facet of roadside development—including historical background, aesthetics, conservation of natural resources in highway construction, rest areas, scenic overlooks, erosion control, landscaping, safety considerations, right-of-way ramifications, and the future of roadside development.

The Highway Research Board hopes that those who are responsible for, or interested in, planning, designing and administering roadside development activities will find valuable reference material in the chapters to follow.

In order to expedite the publishing of this Committee effort, the American Road Builders' Association and the Automotive Safety Foundation generously subscribed in advance for copies of this document. This made possible its publication outside the Board's normal publishing program. The assistance of these two organizations is gratefully acknowledged.

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HISTORICAL BACKGROUND

Roadside development must conserve, enhance, and effectively display the natural beauty of the landscape through which the highway passes, as well as provide safety, utility, economy, and recreation facilities by means of proper location, construction, and maintenance of highways

THIS statement defining the essence of the term "roadside development" might well have emerged from the recent White House Conference on Natural Beauty. In fact, however, it was issued in 1932 by a joint committee comprised of eight members from the Highway Research Board and the American Association of State Highway Officials as an attempt to define formally the subject of the committee's concern.

It was in that year, with the creation of the joint committee, that the first truly coordinated effort was undertaken to guide the practical application of roadside development to America's rapidly growing system of highways.

The committee, some months after its organizational meeting, gathered in Milwaukee to take stock of the laws, funds, organizations, and technical practices pertaining to roadside development. Soon thereafter an additional group called the Committee on Roadside Economics was formed.

By 1939, although substantial progress had been made, it became apparent that even greater impetus could be given roadside development by dissolving the joint committee and by separating the administrative and technical aspects of the subject through the creation of two separate committees. Thus, the American Association of State Highway Officials that year established a Roadside Development Committee primarily responsible for matters of an administrative nature, while the Highway Research Board created a similarly named group to consider solely the technical and research aspects of roadside development.

The Board's Roadside Development Committee was reorganized into three divisions in 1942 to permit a finer delineation of project assignments and to eliminate overlapping and repetitious effort. The three divisions, which continued to function as such for the next decade, were (1) Design, Right-of-Way and Border Control, (2) Construction and Maintenance, and (3) Education, Economics and Public Relations.

The term "Complete Highway" was coined by the Committee in 1943 to describe succinctly the importance of blending into a highway the important elements of design, construction, and maintenance. The "Complete Highway," therefore, had to incorporate utility, safety, beauty, and economy, defined by the Committee as follows:

- Utility* The ability to serve commercial, recreational, local, interstate, and other categories of traffic.
- Safety* The orderly movement of vehicular and pedestrian traffic. There must be ample opportunity to leave the traveled way quickly and safely in emergencies. Turnout areas for rest and relaxation are also involved as are trees to provide shade and other vegetation to mitigate the effects of glare and dust.
- Beauty* The "crowning perfection of that which is useful." Beauty is a basic element in the harmonious integration of engineering, architectural, and landscape techniques. It involves the conservation of shorelines, trees and woodlands, geological formations, and other natural features that provide the components of natural beauty in the highway environment.
- Economy* A combination of effective design and pleasing appearance at a reasonable cost for construction and maintenance. Properly developed roadsides will have tangible economic merit as a result of protection of investment costs, enhancement of land values and contributions to safety.



Figure 1. Some of Oregon's most beautiful scenery is in the Columbia River Gorge a few miles east of Portland on US 30. This aerial view overlooks Crown Point, Rooster Rock State Park and the Columbia River. The sandy beach at left is part of Rooster Rock Park, which offers swimming and picnicking areas, and a boat launching dock. Motorists have a choice of two highways through this area—the water level expressway and the scenic route which follows a bluff through the gorge. Oregon State Highway Department Photograph.



Figure 2. View of George Washington Parkway looking east showing bilevel of lanes A & B with Key Bridge in background.

The “Complete Highway” concept is one which still guides the Committee today as evidenced by this portion of a statement of scope issued last year:

[The Committee’s scope of concern shall be with] . . . all phases of the broad field of roadside development and related functions contributing to the conservation and development of the highway landscape to further the aesthetics of the highway and its structures—all directed toward the goal of the complete highway that combines safety, utility, economy and beauty.

Another reorganization of the Board’s Committee was effected in 1954 to increase its efficiency further by permitting it to function as a “committee of the whole.” The Committee report for that year stated in part:

While it is the intention of the Committee to continue in its future meetings and reports to cover new developments in all phases, more emphasis will be placed on concentrated study of specific technical problems by task committees, usually on a short-term basis rather than acting as standing subcommittees.

Today, the Committee on Roadside Development is an advisory body within the Department of Design of the Highway Research Board. Its principal responsibility is to promote, coordinate, and evaluate research tasks in the several areas that comprise roadside development.

Through the years the Committee has issued comprehensive annual reports, supplemented by numerous bulletins and other special publications, all published by the Highway Research Board. *Bibliography No. 26* lists all the reports published

up to and including 1959. *A Bibliography on Roadside Development and Beautification* was issued by the Board last year and lists by year and subject all HRB publications on roadside development published from 1950 to 1965. These bibliographies, and the reports themselves, are available to anyone seeking guidelines concerning the technical aspects of roadside development. The highly professional composition of the Committee is assurance that the information in these publications is accurate.

REFERENCES

- 1 Upham, Charles M. Twenty Years of Roadside Development. HRB Roadside Development 1951, pp. 4-11
- 2 Neale, Harold J. 30-Year Historical Report of Committee on Roadside Development. HRB Roadside Development 1962, pp. 32-37
- 3 Gordon, George B. The Roadside in Highway Design. HRB Roadside Development 1948, pp. 118-141

AESTHETICS AND ROADSIDE DEVELOPMENT IN HIGHWAY LOCATION AND DESIGN

ON all levels of individual and organization interest—private, civic and governmental—there has been increasing agreement that the planning, location, design, and construction of highways have an effect on society more profound than that involved in the basic responsibility of moving people and products from place to place in safety, convenience, and comfort. In recent years there has also been consideration of the effect a highway has on the total natural and social environment.

The Federal government has provided leadership and incentive in this direction and the Bureau of Public Roads takes every opportunity to steer a forward course for protecting and enhancing natural resources and human values in highway programs. Federal-aid legislation requires state highway departments to hold public hearings on proposed projects bypassing or traversing urban areas, and to consider the economic effect of the projects. This requirement covers all Interstate Highway System projects. A Bureau of Public Roads regulation also requires state highway departments, in planning Federal-aid highway projects, to preserve and enhance natural and cultural resources such as fish and wildlife habitats, scenic and historic sites, parks, playgrounds, and other recreation areas.

States must give public agencies responsible for these resources an opportunity to review highway planning at the earliest possible stage, and must certify to the Bureau that due consideration has been given to suggestions offered by the agencies. If the suggestions are not adopted, valid reasons must be submitted for their rejection.

Federal Highway Administrator Rex M. Whitton stated. "The close scrutiny to which the social, economic, and cultural impact of highways is now subjected has the enthusiastic support of President Johnson whose vision of the Great Society is predicated on the preservation and enhancement of human values. The President has manifested his encouragement by sponsoring a series of legislative proposals to improve the appearance of highways and to provide more opportunities for scenic and recreational enjoyment." (1)

The growing recognition that roads are more than merely service arteries and that highways may provide pleasure and satisfaction to those who see them and travel on them implies that if they are thus identified as an important part of the landscape they will automatically be developed as an integral part of the environment. (2)



Figure 3. Garden State Parkway, New Jersey. Two level roadway, showing conservation of natural growth and screen planting.

THE CONCEPT OF AESTHETICS IN ENVIRONMENTAL HIGHWAY DESIGN

Aesthetic design is concerned with the less tangible qualities of highway location and design. Visual qualities that appeal to the senses of sight, sound, and smell—and to the feelings and enjoyment of people—are not so readily measurable as quantities of construction materials. Nevertheless, aesthetics is the indispensable ingredient in the concept of design that provides for optimum development of the highway in its environment. (3)

Highway location that is sensitive to the character of its environment, has aesthetic design incorporated with structural and geometric design. All three are blended in the total design for optimum development, which includes (a) the structural design of bridges and pavements, (b) the geometric design of roadways and interchanges, and (c) the aesthetic design of the highway as a whole in proper relation to its surroundings. The collaborative process of highway engineer and landscape architect working in this way produces a useful, economical, and attractive highway facility that has more interest and less monotony for the motorist and therefore is less fatiguing and safer to drive. (4)

Environmental highway design emphasizes the three-dimensional character of space-perspective design—structural, geometric, and aesthetic—in preserving and in recreating and restoring beauty in the roadside “link” between the roadways for traffic and the adjacent property interests of the communities through which they pass. (5)

The environmental approach to location and design in developing highways as an integral part of the total land development process recognizes the social

values and responsibilities that transcend the mere transportation of people and goods. Utility must be combined with beauty. In this sense, highways are being routed and built with due regard for the public interest, for established neighborhoods, schools, churches, parks and recreation areas, historic sites, wildlife habitats, and scenic values. Highway location-designers no longer disregard the rights of property owners and the homes and businesses they displace.

Design of open space becomes increasingly important in urban highway development. Wide medians and wide rights-of-way may be the only break in the monotony of a metropolitan complex of highways. Visual amenities are important in the measure of highway values by the public. This is valid reason why the concern with the civic beauty should occupy the highway planner from the start, without waiting for the emergence of an "anti-ugly" opposition. (6)

AESTHETICS AND ROADSIDE DEVELOPMENT

Aesthetics and roadside development are vital in the preservation of the natural beauty of our land and in the need for improvement of our cities. Highway officials are more aware of the need to locate and design highway facilities that are attractive as well as utilitarian. Designers are more sensitive to the need for a sense of highway orientation and order as well as mobility in the location and design of highways. (7)

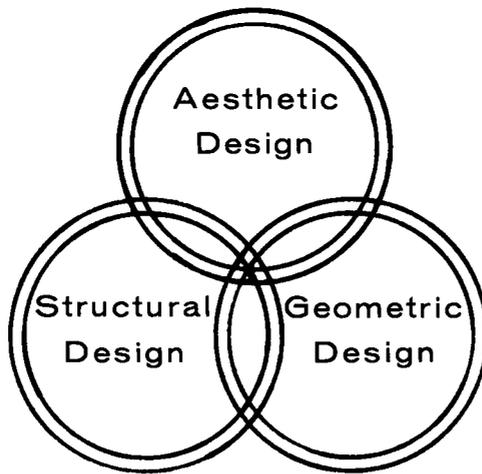


Figure 4. All three types of design must be blended in the total design

Highway engineers are more appreciative of the need for a respite of green grass and trees as well as the grace and strength of geometric design. (8)

State and Federal highway agencies responsible for carrying out the Federal-Aid Highway Act of 1956 (which authorized the Interstate program) are aware of the significant role freeways will play in making the city an attractive and desirable place to live and work. (9)

State highway officials also know that the talents of many professional groups and individual specialists are required to attain the goal of the "Complete Highway"—a highway with all parts designed in harmony with each other—a highway forming a unity of three-dimensional design in keeping with the surroundings—a highway making full contribution of service and value to its rural or urban environment. (10, 11, 12)

EARLY EXAMPLES OF AESTHETICS IN HIGHWAYS

Some 60 years have passed since New York cleaned up the Bronx River and began to lay plans for the Bronx River Parkway, America's first real "parkway" and the forerunner of our nationwide system of controlled-access highways. The Parkway was first opened to traffic in 1924 and it served as a spur to continued attention to the aesthetic aspects of highway location and design.

The Westchester County (N. Y.) Parkway System, in operation by 1930, emulated the concepts and principles of design in the Bronx River Parkway, as did the Long Island parkways around metropolitan New York. In 1932 the beautiful Mount Vernon Memorial Highway, which links the District of Columbia with Washington's birthplace, was dedicated. The building of this scenic highway marked the first time the Federal government coordinated highway construction and roadside development. The result was a balanced relationship between highway engineering and the aesthetics of landscape design, which produced a highway that still brings enjoyment to millions of motorists.

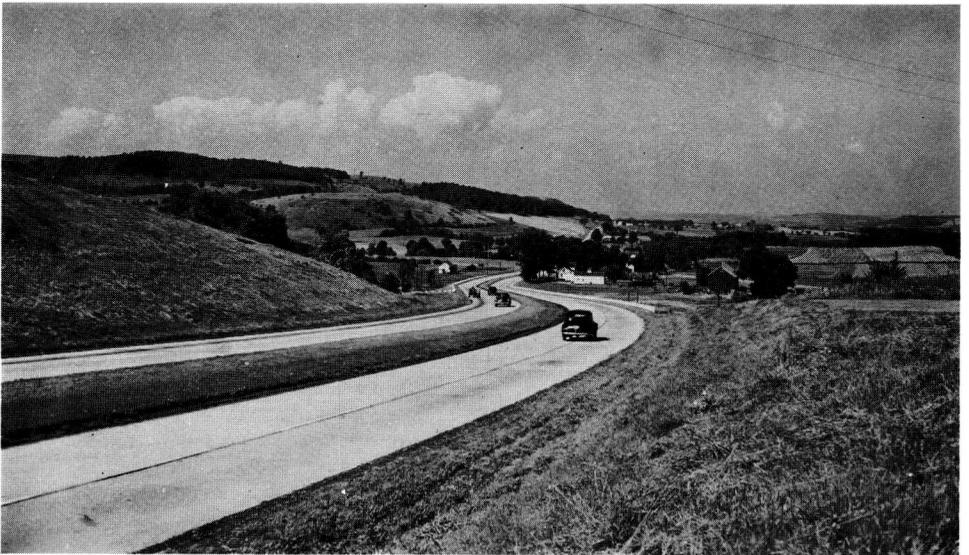


Figure 5. Cherry Valley, New York, showing curvilinear alignment on a divided primary. Photo by courtesy U.S. Bureau of Public Roads.

Aesthetics and roadside development relate to the entire right-of-way. They are concerned with growth or change on abutting lands that affect the appearance or utility of the highway. In the past, *roadside development* was often thought of only as *roadside beautification*, something to be done after the road was completed. This concept has changed. It is now apparent that early attention to "naturalizing" the roadsides provides not only a more pleasing environment for the motorist, but results in lower maintenance costs and safer highways. (13)

Today, the dynamic qualities of aesthetics and roadside development in the engineering of highways are recognized and given consideration in highway programs. Experience is proving that the requirements of good landscape design, when embodied in highway development, enhance the efficiency of use, and do not usually involve more than normal expense—an expense which is fully justified by virtue of the additional public service thus provided. By harmonizing art and science in modern highway design, the present and future value of the highway investment is conserved and protected.

LANDSCAPE PLANNING—AN ESSENTIAL INGREDIENT

Highway landscape planning and scheduling of planting operations have become an essential part of highway engineering and construction. Such planning is necessary to conserve and use effectively the landscape values that exist along virtually all highways. This need for protecting and enhancing the "quality" values of highway environments was emphasized by President Johnson in his Conservation Message on Natural Beauty, sent to the Congress on February 8, 1965, in which he said:

I hope that, at all levels of government, our planners and builders will remember that highway beautification is more than a matter of planting trees or setting aside scenic areas. The roads themselves must reflect, in location and design, increased respect for the natural and social integrity and unity of the landscape and communities through which they pass.

To help further these objectives designed to protect and enhance the beauty of America as seen from its highways, Federal Highway Administrator Whitton issued in late January 1965, a Circular Memorandum to Regional and Division Engineers describing the various actions and first steps to be taken toward achieving the immediately urgent and the long-range goals set down by the President in a letter of January 21 to the Secretary of Commerce.

Regard for the amenities and the visual aspects of highway location and design offer many benefits to the motoring public and to the residents of the areas traveled. Visual variety and interest afforded the traveler reduce the monotony of high-speed driving. The resultant relief from intensity and strain is a contribution to safe driving. Well-landscaped freeways benefit the rural and urban economy by encouraging new industry and business to develop in a park-like manner along the borders. Location and development of urban highways provide the structural framework for urban redevelopment and afford opportunity for large-scale improvement of the immediately surrounding area.

Highways with adequate rights-of-way provide space for trees and grass

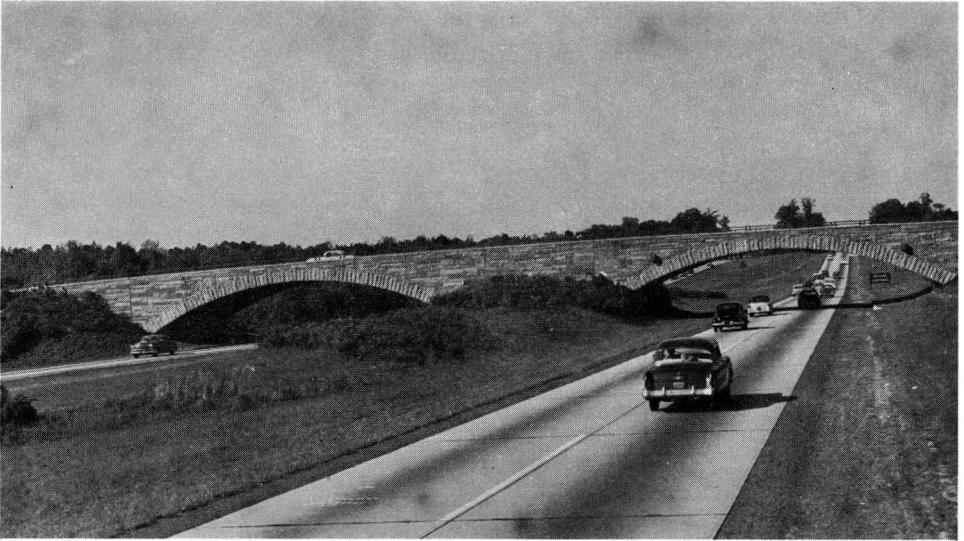


Figure 6. California, showing architectural treatment of structures. Median raised and planted as it approaches the overpass.

which contribute to the creation of a desirable and attractive environment. Such “greenbelts” of open space between areas of intensive development in and near cities often are the only natural features in the urban area. Aesthetic application of landscape design principles is more important than ever before in highway construction programs, not only for the safety and enjoyment of the motorist, but to conserve and stabilize property and community values. Taking advantage of existing beauty and creating and restoring man-made beauty can contribute to every citizen’s pleasure and enjoyment in this era of rapid change and increasing urbanization.

PLANNING NEW HIGHWAY LOCATIONS

In planning new highway locations, the landscape features and points of scenic interest are evaluated by the locator, along with other major factors, as a means of fitting the highway into the landscape. Except in flat terrain, divided highways are considered as two one-way roadways somewhat independent of each other with each roadway fitting the land at varying levels and separations. Efforts are made to reduce disturbance and damage to streams, trees and other natural features by adjustment in the highway alignment, profile grade, and right-of-way cross-section. These efforts produce curves that fit the terrain rather than merely long tangents.

In addition to the fitting of the roadway to the topography, progress has been made in the improvement of the roadside—the area between the shoulders and the right-of-way limits. There has been success in saving and protecting existing trees and other desirable growth on the right-of-way from destruction

before and during construction and in encouraging volunteer growth to enhance the slopes naturally afterwards.

There has also been improvement in the appearance of bridges, retaining walls and drainage structures. The architectural aspects of structures are discussed in the "Landscape Design Guide" prepared by the Operating Committee on Roadside Development and published by the American Association of State Highway Officials in 1965

The aesthetic relationship of the highway to its surroundings must take into account social as well as physical factors. Social environment is as closely related to visual values as it is to highway economics and technology. (14)

Landscape planning for aesthetics is a basic consideration in the early stages of highway location and design in order to provide the optimum of variety and interest for the highway traveler

Aesthetic design must come from the working together of all those responsible for planning and designing highways—and it must be a continuous group effort from the beginning of design, through construction, and into maintenance. This collaborative effort contributes to making the Complete Highway economical to construct and maintain, efficient and safe to travel, and visually attractive to the community as well as the motorist. Aesthetics and roadside development, effectively applied in highway design and location, promote traffic safety by sustaining the interest of the motorist in the beauty of the roadside. (15)

REFERENCES

- 1 The White House Conference on Natural Beauty, Washington, D C, May 24-25, 1965
- 2 Sears, Bradford G Highways as Environmental Elements Highway Research Record, No 93, pp 49-53, 1965
- 3 Simonson, Wilbur H Pro-aesthetics—Conceptual Visual Design of Highways Ohio Twenty-Third Short Course on Roadside Development, pp 49-53, October, 1964
- 4 Simonson, Wilbur H Optimum Landscape Development of Highways Ohio Twenty-Second Short Course on Roadside Development, pp 44-48, October, 1964
- 5 Lehmann, Lawrence L Contour Grading and Drainage Plans for Integrated Highway Design Ohio Twenty-Third Short Course on Roadside Development, pp 59-61, October, 1964
- 6 Pushkarev, Boris Highway Location as a Problem of Urban and Landscape Design Highway Research Record, No 23, pp 7-18, 1963
- 7 Appleyard, D S, Lynch, Kevin, and Myer, J R The View From the Road Cambridge, Mass, MIT Press, 1963
- 8 Tunnard, Christopher, and Pushkarev, Boris The Paved Ribbon The Esthetic of Freeway Design *In Man-Made America Chaos or Control?* pp 157-276, Yale Univ Press, 1963—also—Pushkarev, Boris Esthetic Criteria in Freeway Design Highway Research Board Proc, Vol 41, pp 89-108, 1962—Abstracted in—HRB Roadside Development 1962, p 47
- 9 Freeways in the Urban Setting Conf in Hershey, Pa, June, 1962
- 10 Wells, Nelson M Landscaping *In Highway Engineering Handbook*, Section 28 New York, McGraw-Hill, 1960
- 11 Hewes, Laurence Iisley Highway Landscape *In American Highway Practice*, Vol I, pp 195-255, New York, John Wiley and Sons, 1942
- 12 HARRISS, Lynn M F The Landscape Architect in Highway Transportation Planning *Traffic Quarterly*, pp 43-58, Jan 1965
- 13 Hewes and Oglesby Planning for Roadside Development *In Highway Engineering*, pp 257-265, John Wiley and Sons, 1964
- 14 Parkway for the Mississippi Report to Congress by US Dept of Commerce, Bur of Public Roads, and US Dept of Interior, Nat'l Park Service, Nov 1951 (Public Law 262, 81st Cong) Reprinted 1965
- 15 Principles of Landscape Design *In Interregional Highways*, pp 89-92 House Document 379, 78th Cong, Jan 12, 1944.

RIGHT-OF-WAY, SCENIC AREAS AND ADJACENT LAND USE

ONCE it has been established that a new road is needed, or an existing road must be improved, a development plan must first be prepared. A key element in any development program for a new road is the acquisition of right-of-way. And the most important natural resource in such acquisition is land. Design requirements for new roads call for many acres of land to be withdrawn from agricultural production or other function and maintained simply as part of the highway facility. Seldom does it have any other purpose. A portion of the land is needed for the direct use of traffic. This land is devoted to the pavement, shoulders, median, structures, and drainage ditches. The remainder is considered the roadside and embraces the areas needed to provide transition from the original, natural topography to the topography required for the highway. Under today's concepts, the roadside also may include adjacent areas as they relate to natural beauty. Although the roadside does not contribute directly to the movement of traffic, it is an integral part of the development of a highway as a complete traffic facility.

NEW ROADS

Engineering, safety, and economics traditionally determined the amount of land required for construction of a new road. However, these factors no longer are the only considerations used in determining highway rights-of-way. Additional factors involving aesthetics, pleasure, and recreation are now fully recognized as very important.

This concept of the "Complete Highway" requires land beyond that normally needed for construction. Additional land is required for the development of the roadsides for aesthetics, pleasure and recreation. And that additional acquisition is, in turn, affected by land costs involved in the conservation of natural, historic, and other resources, and the provision for zoning and facilities for safety, rest and recreation.

In urban areas adjacent to new highways, land costs are obviously high, opportunities for roadside development are limited, and the primary needs are related to safety, rest, and zoning. However, in rural areas, land costs may be low and opportunities high for the development of roadside facilities. In such areas more and more new highways are being located to take advantage of the scenic and historic resources. For example, the standards and location of the National

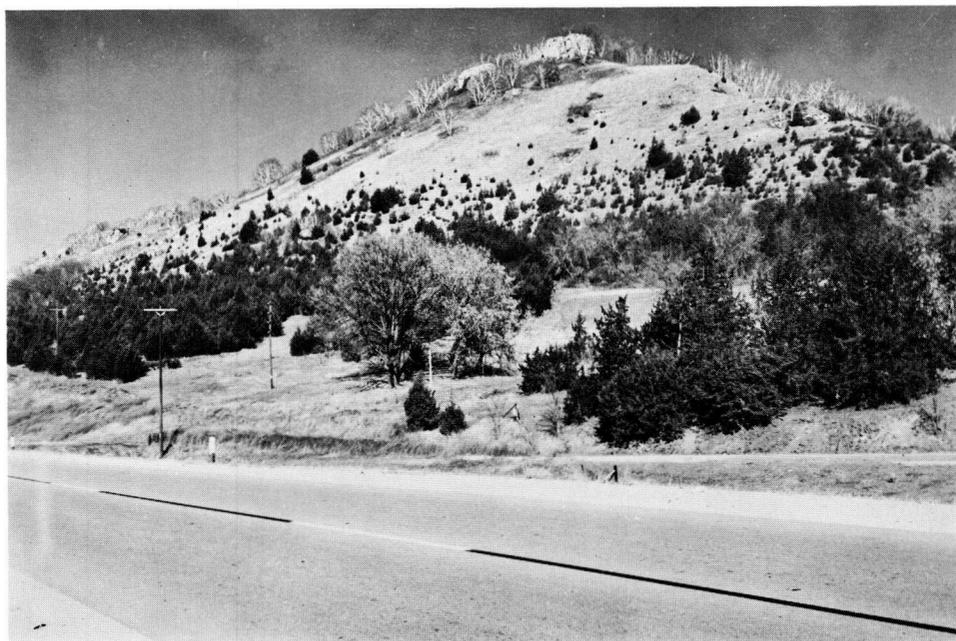


Figure 7. Scenic easements are now being acquired along this section of the Great River Road in Wisconsin and will extend to the top of the bluff. The 3,800-mile-long Great River Road is a National Parkway being developed by the ten Mississippi River states according to jointly acceptable Federal, state, and local programs.

Park Service roads are dictated by the special resource values of the area. Because of the use for which such National Parkways are created, a right-of-way averaging 125 acres per mile is acquired for the preservation, protection and development of "scenic corridors."

EXISTING ROADS

For existing roads, rights-of-way are of varied, but fixed, dimensions. In view of the increasing trend toward the greater use of existing roads for purposes other than business, there is a growing awareness of the need for additional right-of-way or other improvements to provide facilities for the pleasure, comfort and convenience of the pleasure drive. Considerable research has been done in this field and some highway and other agencies have established criteria and activated programs of roadside development.

Existing National Parkways provide 1,100 miles of slow-speed scenic roads on which commercial traffic is prohibited, and facilities and programs are provided for camping, picnicking, hiking and special activities. Some of the adjacent scenic areas are as large as 4,200 acres. The State of California has established a 4,900-mile scenic road system. The 3,800-mile Great River Road is being developed by the ten Mississippi River states according to jointly acceptable



Figure 8. Mabry Mill located along the Blue Ridge Parkway provides an interesting scenic area for the leisurely motorist.

Federal, state and local programs. A Federal study for a National Program of Scenic Roads and Parkways presently is under way. Many states have programs which call for additional rights-of-way for scenic purposes and the development of roadside facilities for motorist comfort and pleasure.

LAND ACQUISITION PROGRAMS

Land acquisition programs for preservation or development of scenic quality in roadside areas may take various forms. One of the most recent major opportunities in this regard is provided under the provisions of the Highway Beautification Act of 1965, amending the Federal law to encourage more extensive use of Federal-aid highway funds for landscaping and scenic enhancement. (See Chapter Four.) Section 319 of the 1965 law (Title 23, United States Code, *Highways*) provides that state highway departments shall use up to 3 percent of their state's apportionment of Federal-aid funds for landscape and roadside development within the right-of-way, and for acquisition and improvement of strips of land needed for restoration, preservation, and enhancement of scenic beauty adjacent to the highway. These funds may also be used for acquisition and development of



PICNIC AREA ALONG THE LEVEE
THE GREAT RIVER ROAD

Figure 9

publicly owned and controlled rest and recreation areas and sanitary and other facilities deemed reasonably necessary to accommodate the traveling public. Federal funds available under Section 319 need not be matched by state funds.

Wisconsin, in its Outdoor Recreation and Resource Development Act of 1961, demonstrated how highway scenic development could be combined with imaginative efforts to serve the state's interest in conservation, outdoor recreation, historic site preservation, and resource development. Financed by a one-cent per package tax on cigarettes, the state's program anticipates that over a 10 year period some \$50 million will be available for its use. Funds totaling \$693,000 have been budgeted for the purchase of scenic easements along highways, and Wisconsin has by this means been able to develop extensive continuous portions of its segment of the Great River Road, and commence acquisition of protective easements in other parts of the state. In addition to scenic easements, the Wisconsin highway department has acquired land for access connections, waysides, and overlooks.

Any project in the National Parkway program requires Congressional recognition. States through which a National Parkway passes acquire land at an



Figure 10. This parkway in the southern Virginia highlands is a classic example of how the road is fitted to terrain that boasts a wealth of natural growth. The right-of-way averages 125 acres per mile.



Figure 11. Interesting land use patterns are being preserved by the application of scenic easement and special use permits as shown here along the Blue Ridge Parkway.

average rate of 125 acres per mile in fee simple title and 25 acres of scenic easement interest. Title and interest are deeded to the Federal government. The Federal government has complete responsibility for parkway construction, roadside and scenic area development, maintenance, administration, and protection. National Parkways essentially are elongated parks possessing significant scenic, historic and other resources, featuring a motor road designed for the leisurely passenger car traveler. Present Congressional authorizations provide \$16 million annually for National Parkways.

PREVENTING OR REDUCING ADVERSE LAND USE

One of the primary objectives of all programs of roadside development is the prevention of adverse use of land along new highways and the elimination or reduction of adverse use along existing highways. Adverse land use includes outdoor advertising, utility lines, ribbon development of business and residences, automobile graveyards, quarries, public dumps, and public and private accesses at grade.

Much study and research is being given to programs of highway development and improvement through the use of advance planning, zoning, easements, permits, and restrictive legislation. Adverse land use can be anticipated and prevented or controlled on new highways through careful planning. On existing highways, such

adverse land usage may prevent the highway from completely fitting its environment. However, the conditions can be improved or corrected by applying zoning, by acquiring accesses or controlling use of access, by purchasing easements where land costs are high, by negotiating special-use permits for the purpose of reducing maintenance costs and controlling environment, and by securing legislation giving protection to the roadside and the scenic corridor

The states are becoming more and more interested in the use of scenic easements and special-use permits, and are using precedents some of which were established as early as 1932 by the National Park Service of the Department of the Interior. The Park Service also has in effect long-range land-use plans which are of material benefit in the control and management of vegetation, maintenance, and the programming of funds for development.

In summary, proposed and existing highways can be made more satisfying through programs of roadside development that use additional rights-of-way to provide facilities for comfort, convenience, recreation, and for scenic pleasure. Funds are available to aid in advancing these programs

REFERENCES

- 1 Symposium on Parkway Concepts and Principles HRB Roadside Development 1961, pp 59-76
- 2 Pough, Richard H Roadside as Living Museums of Natural History HRB Roadside Development 1956, pp 18-21
- 3 Roadside Their Use and Protection Highway Research Board Spec Rept 17, 1954

CONSERVATION OF NATURAL RESOURCES IN HIGHWAY DESIGN AND CONSTRUCTION

THE value of natural scenery is magnified in urban areas simply because of its location. Although this facet of conservation is not discussed at length here, it must be stressed that every opportunity should be taken to capitalize on such resources whenever they are available. Frequently these natural features are large bodies of water, be they rivers, lakes, or ocean inlets. They can be seen from bridge approaches, bridges and from adjacent highways. Consideration of the value of such features, and appropriate design to exploit fully their scenic potential, can add greatly to the beauty of the urban scene.

A large portion of our Nation's natural scenery is blended with man-made features. This scenery, the sum total of all visible components of the landscape, should be the prime objective of conservation efforts in highway construction.

The conservation of natural scenery along the route of new or reconstructed highways requires the highway designer's appreciation of everything visible from the highway. It also requires that the designer be given the benefit of appropriate engineering, landscape architectural and legal assistance in applying those principles and techniques necessary to make the most of the existing natural scenery.

NATURAL RESOURCE INVENTORY—A FIRST STEP

An inventory of the scenic and other natural resources along the route of the proposed highway should be made early in the design process. Although such inventories, or field reconnaissance surveys, are not widely made at present, the technique is logical and desirable in that it permits the designer to determine the optimum conservation and display considerations by which to present effectively the highway's scenic features. In certain situations, the importance or uniqueness of such features may affect the design of the highway by justifying a modification of the proposed line and grade.

The natural resources or features to be inventoried vary somewhat with the region of the country. The list below is typical.

1. Near and distant views of scenery typical of the area,
2. Water areas such as streams, lakes, rivers, ocean inlets, marshes and swamps;
3. Unusual panoramic views;
4. Existing trees or other vegetation,

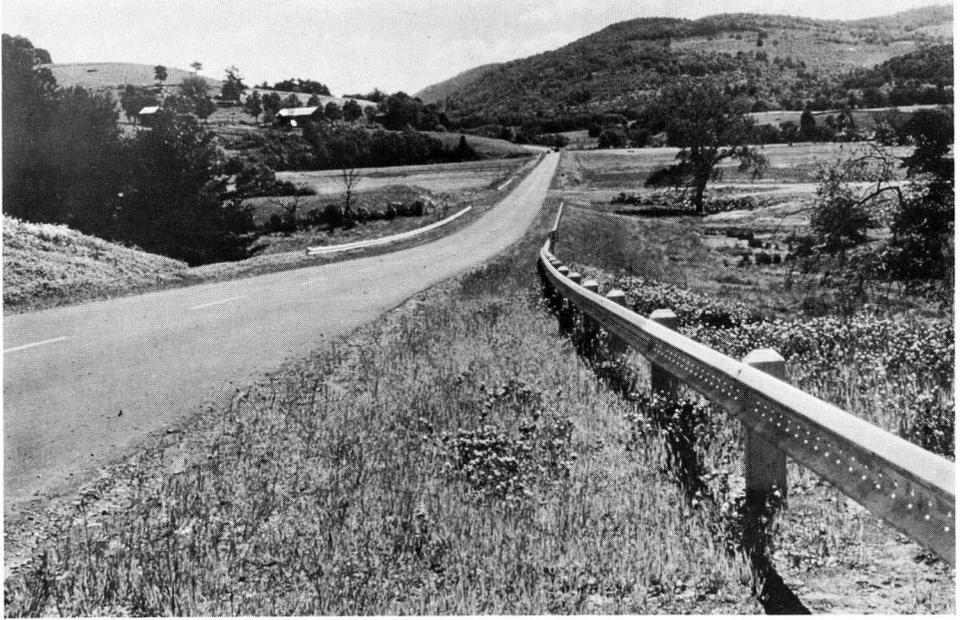


Figure 12. The dominant feature of this road is the natural scenery surrounding it.



Figure 13. A view such as this from the road is always pleasing to the motorist. "Vista cutting" of tree growth in the foreground will be necessary to preserve the view.

5. Massive or interesting rock formations; and
6. Any other unusual natural features.

In this sense the inventory might also include certain man-made features such as extraordinary architecture, dams, bridges, historical buildings and the like.

Natural features that are inventoried must necessarily be large enough to be seen and appreciated by the motorist as he travels. For smaller scale features, provision can be made for a scenic overlook or safety parking area and the inventory will assist in locating potential sites for them.

Those features which detract from the natural scenery should be noted in the inventory, and thought should be given to means for making them less objectionable.

When evaluating methods to conserve desirable natural features listed in the inventory, the designer should consider the following factors:

1. The effects of alignment, profile and section on scenic landscape.
2. The advantages to be taken of views of interesting, unique or typical features such as lakes, streams, mountains, rock formations, valleys, woodland and farm land.
3. The location of borrow pits and spoil banks to prevent their being seen from the highway, or provisions for the proper grading and seeding of such areas so they are not intrusive in the landscape. Spoil material can often be incorporated into fills to create flatter slopes.
4. The scenic overlooks or roadside parks to be provided as required.

It is frequently necessary to do "vista cutting" (removing obscuring vegetation) to permit proper viewing from the roadway, a scenic overlook or roadside park. This operation can be considered as a device to direct attention to natural beauty resources.

Usually the natural scenery visible from the highway is outside the normal right-of-way and, if the desired landscape effect is to be achieved, additional land must be taken. (See Chapter Three.)

Section 319 of Title 23 of the U.S. Code as amended by the Highway Beautification Act of 1965, expanded the legal authority for use of Federal funds for acquisition of land beyond the normal right-of-way as follows:

Section 319 Landscaping and Scenic Enhancement

(a) The Secretary [of Commerce] may approve as a part of the construction of Federal-aid highways the costs of landscape and roadside development, including acquisition and development of publicly owned and controlled rest and recreation areas and sanitary and other facilities reasonably necessary to accommodate the traveling public.

(b) An amount equivalent to 3 per centum of the funds apportioned to a State for Federal-aid highways for any fiscal year shall be allocated to that State out of funds appropriated under authority of this subsection, which shall be used for acquisition of interests in and improvement of strips of land necessary for the restoration, preservation, and enhancement of scenic beauty adjacent to such highways, including acquisition and development of publicly owned and controlled rest



Figure 14. An intersection on the Blue Ridge Parkway: (a) before selective thinning; (b) after selective thinning showing improved sight distance and interesting shrub growth.

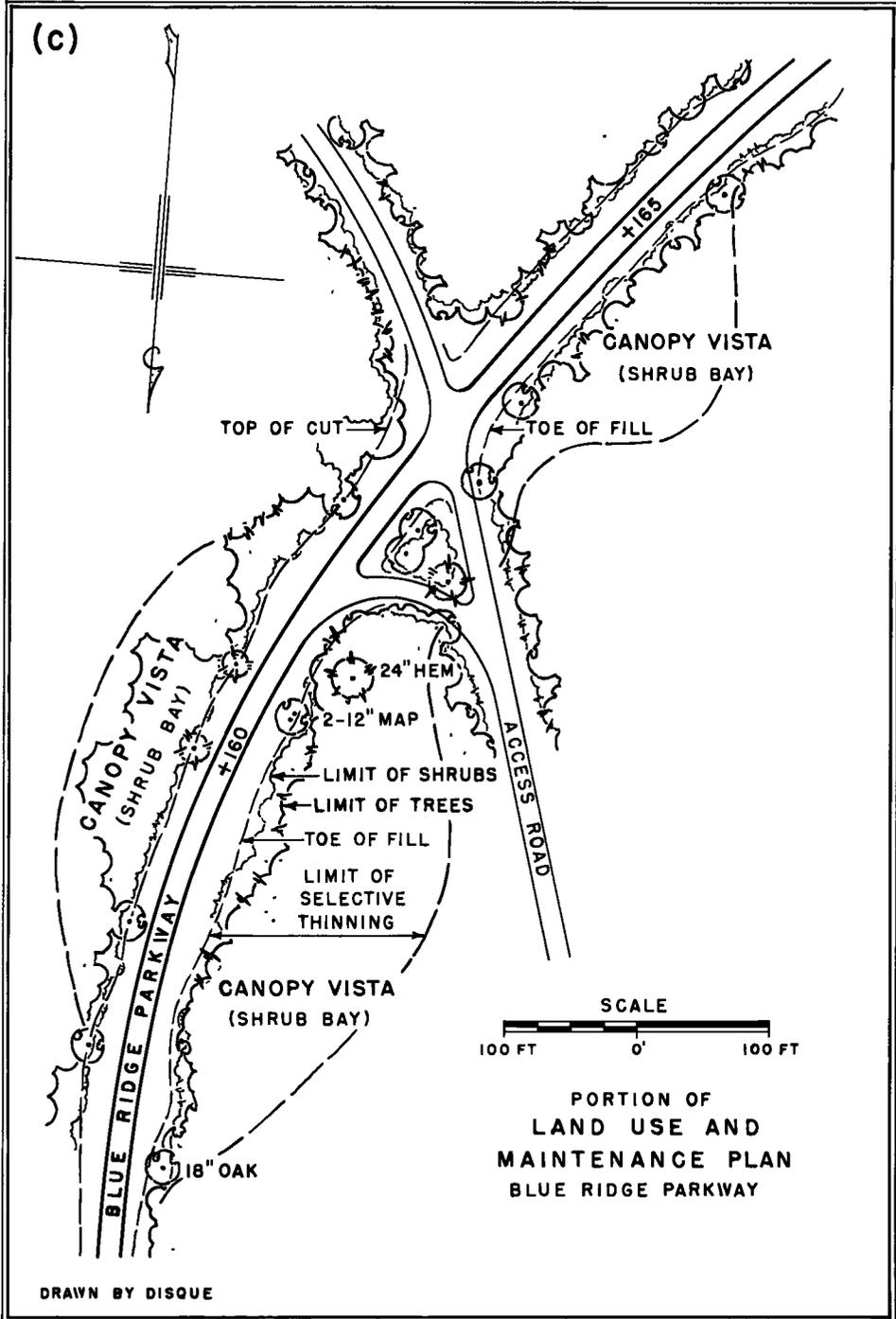


Figure 14 (continued). (c) Land use and maintenance plan for selective thinning.



Figure 15. A road near the Wawona Tunnel in the Yosemite National Park: (a) before "vista cutting"; (b) after the removal of two large trees, Bridal Veil Falls can now be seen.

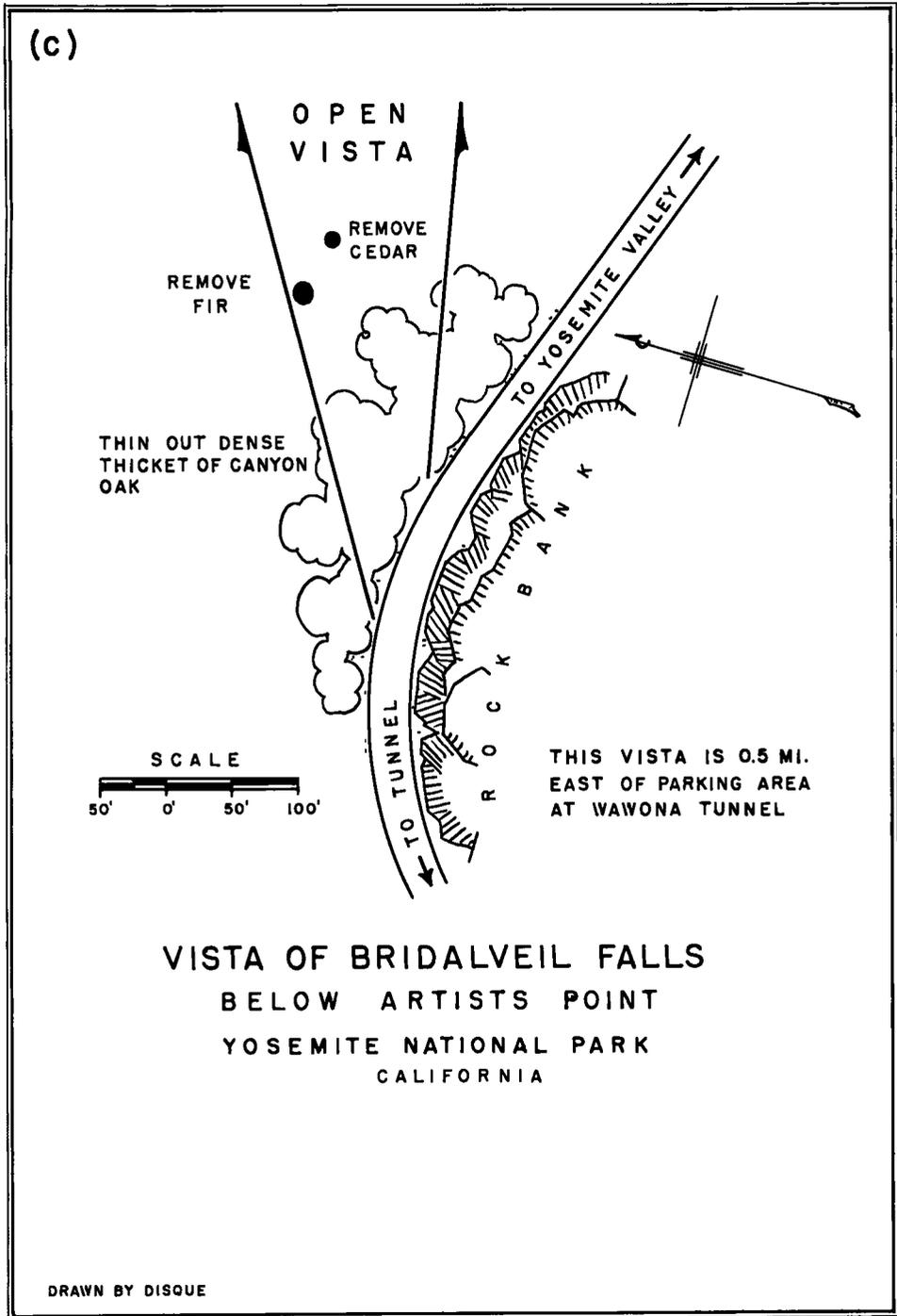
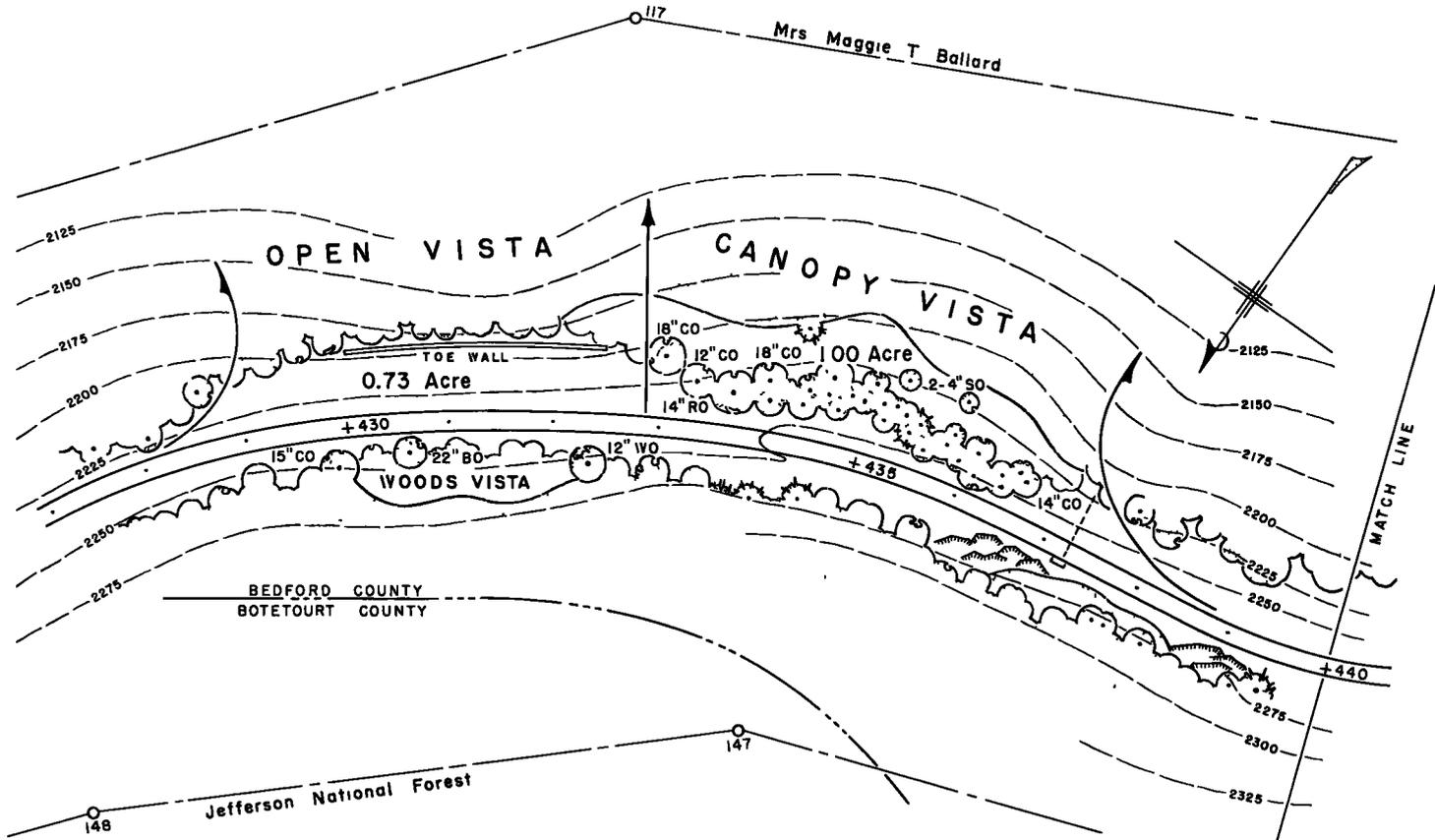


Figure 15 (continued). (c) Diagram of "vista cutting".



U S DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

DRAWN FROM
VISTA CLEARING PLAN
CANOPY VISTA - SECTION I-K, STA 433-437
BLUE RIDGE PARKWAY

Figure 16. Planning natural resources conservation during design stage.

and recreation areas and sanitary and other facilities reasonably necessary to accommodate the traveling public, without being matched by the State. The Secretary may authorize exceptions from this requirement, upon application of a State and upon a showing that such amount is in excess of the needs of the State for these purposes. Any funds not used as required by this subsection shall lapse. . . .

Feeling that widespread use of this provision was essential to any meaningful, large-scale effort to conserve natural scenery on a nationwide basis, Congress in the 1965 legislation authorized appropriation of \$120 million for each of the fiscal years 1966 and 1967 to finance state implementation of this feature of the law. It was specified that no part of the Highway Trust Fund should be available for this part of the Federal-aid highway program. It is anticipated that during their 1966 and 1967 legislative sessions many states will consider additional legislation to enable them to make full utilization of this new authority in the Federal law.



Figure 17. The preservation of trees in the median strip adds greatly to the appearance of a highway in winter as well as in summer.

CONSERVING EXISTING NATURAL FEATURES DURING CONSTRUCTION

The conservation of existing natural features has already been partly covered considering the features as components of the total landscape. But what of those existing natural features which are encountered during highway design and construction?

Plans and specifications must reflect the design decisions made as a result

of the scenic inventory and must be specific as to action necessary to conserve the features. Some of the points concerning existing natural resources which must be considered during construction are the following:

1. Desirable trees should be preserved consistent with good land forms, safety, and sound horticultural practice. This will usually require an exact definition of the limits of the clearing, grubbing, and construction. Measures to insure proper care of trees and other vegetation by the contractor include fencing, marking of boundaries, and penalties if trees are damaged.
2. Disruption or relocation of channels of natural drainage ways (streams, creeks and rivers) should be avoided as much as possible.
3. Erosion should be prevented by the establishment of appropriate vegetation on the soil surfaces exposed by construction.
4. All haul roads, contractor service areas, etc., should be regraded or restored to blend into existing earth forms and seeded and planted.
5. Selective thinning should be done to obtain the mature landscape effect sought.

SALVAGE OF NATURAL MATERIALS

Natural materials usually considered for salvage and later use in roadside development are discussed briefly below.

Topsoil

Topsoil is salvaged more frequently than any other material. Specifications for topsoil vary from state to state, but it is basically the top layer of soil suitable for agricultural purposes, containing not over 20 percent organic material and a percentage of "fines" (soil particles passing through a sieve with 200 openings per inch) ranging between 20 to 80 percent. Salvaged topsoil is for use on areas to be seeded to turf species, or for use in tree and shrub planting work. The amount, quality and accessibility of topsoil to be salvaged is usually determined during the early field reconnaissance.

Plant Materials

The salvage of existing plant materials (by contract forces) at a reasonable cost is seldom possible. Usually, if the salvaged plant materials are to be used on the same project, they must be set out in nursery rows and watered, cultivated, etc., until grading has been completed on the areas where they are to be planted. Economic and horticultural considerations seldom justify this operation.

Peat and Muck

Peat and muck, which are similar and relatively common in certain areas of the country, are usually "wasted" because they are not structurally stable. In some situations, however, they are sidecast and used to flatten fill slopes. A small amount of these materials, if acceptable, may sometimes be salvaged for use in planting, but this is not usually done on a large scale.

Unclassified Excavation Material

Unclassified excavation material suitable for the growth of grass is usually found below the topsoil layer. It does not contain organic material and may have a relatively low percentage of fines (20% to 30% or higher). It also does not meet the requirements for topsoil but is considerably less expensive and may be used in place of topsoil in certain situations. In some areas, its use may be preferable to the use of high-quality topsoil which would have to be stripped from agricultural lands

Stones and Boulders

Boulders are occasionally salvaged for use as "boulder guide railing" along scenic overlooks, parking areas, roadside parks and to a lesser degree along roads in scenic areas and along parkways. Large boulders can sometimes be used as landscape features. Stone suitable for masonry walls is occasionally salvaged on a small scale

Standing Timber

Timber growing within the highway limits of construction is sometimes suitable for lumber, and can be salvaged by a private logger who has the men and equipment for such an operation. It is seldom practical for state or contractor forces to attempt the actual lumbering operation. Use of the revenue from such an operation will vary with the state and contract conditions.

Other Materials

Sand (as a soil amendment), clay (as a soil amendment), sod, peat moss, and marl are sometimes considered for salvage, but an analysis of the cost involved indicates that such an operation is seldom justified.

REFERENCES

- 1 Disque, Earl A., Moderator Symposium on Parkway Concepts and Principles HRB Roadside Development 1961, pp 59-76
- 2 Selective Cutting of Roadside Vegetation for Improved Highway Safety, Appearance, and Use Conclusion Highway Research Board Spec Rept 43, p 42, 1959
- 3 Roadside Development as Related to the Interstate System HRB Roadside Development 1958, pp 55-70
- 4 Usher, James M. Roadside Problems on the Interstate Highway System Forest Conservation Aspects HRB Roadside Development 1957, pp 20-32
- 5 Roadsides Their Use and Protection Highway Research Board Spec Rept 17, 1954
- 6 Pushkarev, Boris. Esthetic Criteria in Freeway Design HRB *Proc*, Vol. 41, pp. 89-108, 1962

EROSION CONTROL

IN the wake of the first tremendous drive to provide all-weather surface roads for automobiles in the 1920's, highway engineers began to note with alarm the results of erosion on newly constructed cross-sections. Wind and water would move the earth, which in turn would undermine structures, vitiate drainage installations, and damage land and water supplies on adjacent property through the deposition of subsoil. Because damage caused by erosion called for additional maintenance expenditures, economics became the primary factor that motivated highway administrators to employ professionally trained men to control erosion by developing methods and techniques for establishing vegetation on newly graded roadside areas.

Erosion control and the stabilization of soil areas form the essence of soil conservation. With almost 35 million miles of highway rights-of-way in the United States, many millions of acres of adjacent land are affected by drainage patterns which originate within these areas. An erosion resistant cover of vegetation in drainage channels and on other roadside areas plays a significant role in the action of water on lands beyond right-of-way fences. The condition, design, and adequacy of drainage facilities, and the highway areas over which water must flow, determine the degree of destruction potential of runoff. A combination of adequate drainage and suitable vegetation offers the best means of soil conservation on the right-of-way and adjacent lands.

Roadside development actually started as a result of the need to control erosion. Even today, the importance of erosion control is second only to the need for adequate design and location considerations. To achieve an effective and harmonious relationship between the highway right-of-way and the adjoining countryside it is still imperative that vegetation be used to control erosion on construction scar areas, thereby making possible their restoration as an integral part of an aesthetically pleasing, unobtrusive and natural roadside environment. The "Complete Highway" is not a reality until all soil areas are protected with appropriate vegetation.

DESIGN CONSIDERATIONS

Good cross-section design is a basic factor in attaining successful erosion control results. Slopes designed as flat as economically practical, with adequate rounding at both top and bottom and with appropriate transitional grading between cuts and fills, will improve appearance and highway safety, facilitate

establishment of a vegetative cover, and reduce maintenance costs. Other considerations relating specifically to erosion control include climate, geologic formations, soil types, and drainage design that considers adjacent land problems as well as the roadway itself.

SOIL PREPARATION

Justification for soil preparation varies with the location and degree of maintenance to be employed. Existing topsoil should be salvaged and used on areas other than steep slopes where turf is the desired ground cover. In urban areas it is particularly important that topsoil be placed on subsoil areas to stimulate the establishment and continued growth of the turf. Borrow topsoil except on urban projects is seldom justified. When topsoil is used, it is important to blend and form a bond between the topsoil and existing subsoil.

Experience and many research studies have shown that effective cover of vegetation can be established and maintained on subsoil areas provided adequate fertilizer is furnished. Soil fertility tests are the surest means of determining fertilizer requirements. A scarified, noncrusted surface will normally produce good results in humid sections of the country. More extensive soil preparation may be necessary to establish a cover of grass or other vegetation in arid sections.

ESTABLISHING GRASS

Grasses used vary greatly with climatic conditions. Experiments have been carried out in practically all sections of the United States to determine the varieties, rate, and time of seeding best adapted to highway work. Selection of grass species is governed by climate, soil and nutrient factors, the type of roadside area and management to be employed. State universities and Federal agencies are reliable sources of assistance in varietal selection. Normally, the best seeding times are in the fall and early spring, but unfortunately the completion of construction often does not coincide with optimum seeding seasons. Two seeding operations are used to meet this problem and to prevent erosion: first to establish a temporary stand of quick germinating annual grasses followed later by reseeding with perennial species at the proper season. Experience has shown that speed in preventing erosion pays big dividends.

Any method of sowing seed that distributes it uniformly over the surface is acceptable. Mechanical tractor-drawn seeders and seeder-cultipackers have proven economical on level areas and flat slopes. Hydraulic seeders, which apply seed and fertilizer in one operation, give satisfactory results on steep slopes at minimum cost. Experiments have shown that seeding over or under mulch produces equally good results. And in some instances seed and mulch placed directly on untilled soil can produce satisfactory results at a minimum cost.

Sprigging, which employs stolons or rhizomes to establish grass, is used in regions where suitable species are available. A variation is "mulch sodding"—the placing on slope areas of approximately four inches of a mixture of grass roots and surface soils. Disks, harrows, weeders and rotary-type pulverizers and mixers are used to prepare and collect sprigs mechanically.

The use of sod has decreased generally due to cost and scarcity. Sod, however, may be justified in critical areas such as culvert headways, drop structures, catch basins and drainage channels. Power cutters have mechanized sodding.

MULCHING

Mulch is defined as a surface cover of either organic or inorganic material, and "mulching" is the practice of partial incorporation of mulch into the soil as a means of holding it in place; mulching does not mean fully incorporating the material as a soil amendment, or the tillage practice of soil mulch or dust mulch. According to a New York State research project titled "Vegetative Cover" (1):

Mulch constitutes one of the more economical means of markedly improving conditions in the top inch or so of surface soil layers for germinating and growth of seedlings. One of the most important functions of a mulch is to reduce evaporation losses of soil moisture. Mulch also holds a layer of relatively still air that serves to insulate the soil against solar radiation. Soil and air temperatures and humidity in the germination and early-growth zones are kept much more uniform than those on similar non-mulched areas. Penetration of rain water and growth of seedling roots is facilitated through the prevention of surface crusting.

Conservation of soil moisture is accomplished by a mulch. Such moisture economies, though small, often make the difference between successful and unsuccessful establishment of turf cover.

Mulching has become an integral part of seeding operations for erosion control. Hay and straw are the most commonly used mulch materials but other locally available materials are often used, including pine and other leaf litter, peat moss, fish solubles, tobacco stems, cotton-seed hulls, threshed soybean plants, corn stalks and cobs, sawdust, excelsior and bagasse.

Hay and straw, with or without the addition of asphalt, are blown on slopes mechanically. Wood fibers, combined with seed and fertilizer and applied in one operation, are also favored in some areas. They are applied hydraulically, are available at any season of the year, require no additional anchoring and are less subject to the hazards of fire.

Hay or straw mulch, under most conditions, is held in place with asphalt. Wooden stakes, driven on 18-inch centers have held straw successfully on 1-to-1 slopes as has chicken wire fastened with metal ties or wood stakes. Other materials, including jute netting, paper-mesh materials, elastomeric polymer emulsion, glass fibers and blankets, and asphalts in combination with glass fibers, are currently being used. (2)

Research results show that certain mulches actually improve the soil environment and seedling establishment. Barkley (3) found that straw mulch and wood-fiber cellulose gave fast germination and better seedling stands growth. The material also was found to moderate soil temperatures and improve soil moisture as compared with no mulch and certain other mulch treatments. Button and Porharst (4) found that wood cellulose fiber was equal to hay as a mulch material. Blaser (5) noted that sod development with straw mulch was somewhat faster than with wood cellulose fiber, but both materials were very satisfactory.

Richardson and Diseker (6) found that a crop of Abruzzi rye that later served as a mulch in place was superior for establishing crown vetch as compared to net type materials, such as jute, glass fiber, paper, and no mulch. On the other hand, competition from fast-growing seedlings of small grains and ryegrass usually retard the more slowly developing desirable seedlings (7, 8)

Flat slopes permit the mechanical anchoring of hay or straw. Normally applied at 1½ to 2 tons per acre, anchoring can be accomplished by a farm-type disk harrow with the disks set straight, a mulching tiller, a rotary-type pulverizer or mixer, or a sheepsfoot roller, which also combines compaction. Unless the ground surface is too hard, metal-tracked tractors can also be used.

SPECIAL SITUATIONS

Special erosion control methods have evolved from special problems. For instance, seeding and fertilization by helicopter or other aircraft have been used successfully to attain vegetation in high cut and fill slopes that could not be worked with conventional equipment. Costs were comparable with other mechanical means. Sandy soils require specialized treatment, particularly where high winds are the erosive problem. To be successful in such cases, the top grain of sand must be stabilized. Crushed rock or gravel materials have proven effective and their application can be followed by seeding and fertilization where vegetation is practical. Seeding, fertilization and straw mulch tied down with wire netting have been used successfully.

Sand dune control is a difficult and costly stabilization problem. Culms of European and American beachgrass are normally employed as the first step in stabilization, followed by the seeding of various grasses and legumes. Shrubs and trees are planted for the final cover. Extraordinary precautions to prevent fires must be taken in West Coast areas.

Drainageways prevent special problems involving safety, appearance, and adjoining lands. Vegetative cover as a control has limitations with respect to channel capacity and permissible velocity. In addition to mechanical erosion control methods such as temporary check dams or permanent-type construction, there have been many experiments designed to stabilize and protect interceptor dikes and channels pending establishment of suitable vegetation. Many materials were used, including jute netting, glass fibers (alone or with asphalt), paper netting, and glass fiber matting. Although the results have not been uniformly conclusive, the variety of materials suggests that industry is aware of the problem and is cooperating in the development of suitable materials for special erosion control problems.

FERTILIZATION REQUIREMENTS

The use of fertilizers has contributed to less use of topsoil and has permitted the satisfactory establishment of erosion control ground covers on subsoil. Even though nitrogen is normally the most deficient element in subsoils, complete fertilizers are generally used. Fertility requirements, including lime, can be reliably determined by soil tests. The conclusion on refertilization recorded in the New York report (1) warrants repeating

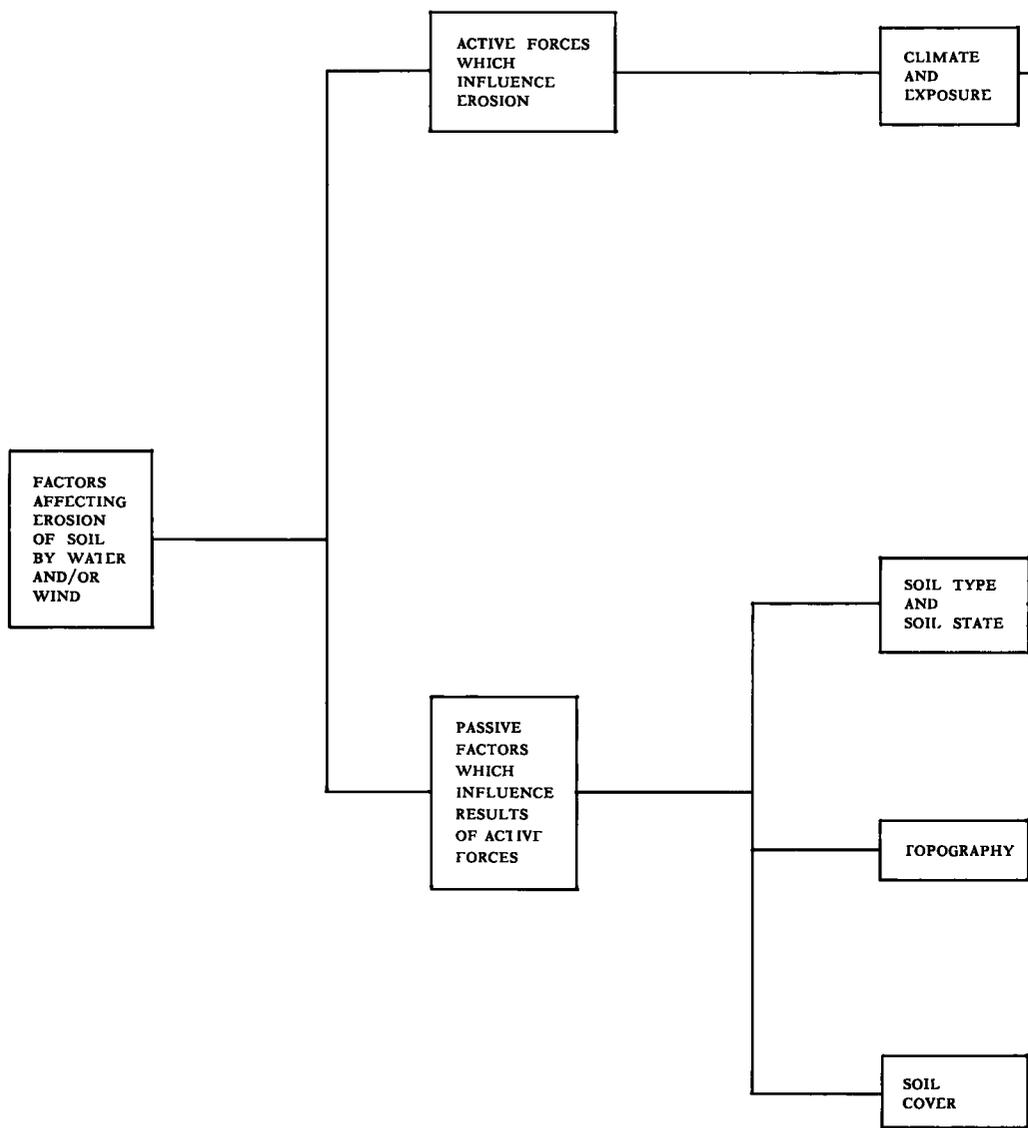


Figure 18 Principal factors which influence soil erosion.

ELEMENTS

INFLUENCE OF FACTORS ON SOIL EROSION

RAIN FALL
Intensity, Duration and Seasonal Distribution

Raindrop Splash Erosion Breaks down aggregates, dislodges and disperses soil. May compact and seal surface affecting infiltration
Flow Erosion Physical force due to pressure difference, dislodges, disperses, and transports suspension. Intensity and duration influence runoff after infiltration capacity is reached

TEMPERATURE AND EXPOSURE

Alternate Freezing and Thawing (FT) and Wetting and Drying (WD) FT expands soil, increases moisture content and decreases cohesion facilitating dislodgement, dispersion and transport. More severe South and West exposures also increase difficulty of maintaining vegetative cover

WIND

Impact and Saltation Dislodges by force due to pressure difference aided by impact. Movement largely by saltation (bouncing along ground surface)

PROPERTIES OF THE SOIL MASS

Granulation May promote ease of dislodgement
Stratification Stratum of low porosity and permeability may control infiltration rate through overlying layer and thus affect runoff
Porosity Determines waterholding capacity
Permeability Determine percolation rate. Both porosity and permeability influence infiltration and runoff
Volume Change and Dispersion Properties Soil swelling loosens soil—reduces cohesion and facilitates dislodgement. Easily dispersed soils erode more readily
Moisture Content Moisture reduces cohesion lengthens erosion period by reducing period of infiltration before runoff occurs
Frost Susceptibility Determines intensity of ice formation and increase in porosity and moisture content and reduction in strength. Markedly increases erosion

PROPERTIES OF SOIL CONSTITUENTS

Grain Size and Sp Gravity Determine force needed for dislodgement and movement by wind or water

DEGREE OF SLOPE AND LENGTH OF SLOPE

Degree of Slope Influences velocity of flow
Length of Slope Influences quantity (depth) of flow and velocity (profile gradient). Depth influences turbulence. Both velocity and turbulence markedly affect erosion

VEGETATION, AND PAVED SURFACES

Vegetation Grasses, legumes, vines, shrubs and trees in proportion to interception of raindrops by canopy and protection against flow erosion. They decrease velocity of runoff and cutting action of water, increase infiltration by increasing porosity, and reduce soil moisture (transpiration)

Non-Vegetative Stabilized Surfaces To increase bearing value and to resist erosion
Paved Surfaces Shoulder, slope and gutter pavements

Combination of Above Types Stabilized turf shoulders.

The fertility level of the soil must remain high enough to maintain a vegetative cover. When need for fertilizer is indicated by the appearance of the vegetation, it should be applied in amounts sufficient to meet the deficiency, but not in such excess as to cause unnecessarily heavy top growth. Grasses for roadside cover generally should be maintained at minimum nutrient levels so as not to cause undue mowing expense.

SHRUB AND VINE GROUND COVERS

Grass is used most often for erosion control. It has the least initial cost, it can be left to grow without mowing, or it can be groomed to varying degrees of excellence by machine operations. With reasonable care it persists for long periods. There are situations that require other ground cover plants in urban locations and at interchanges where slopes are too steep to be maintained mechanically or where, for aesthetic reasons, turf is not desirable. In such situations, low growing shrubs can be used. Where they can be grown, vines like English ivy, bittersweet, vinca or periwinkle, euonymus, and bearberry make effective ground cover for slopes and require practically no maintenance once they are established. Other taller growing shrubs can be used for the same purposes—to improve appearance, to stop erosion, and reduce the cost of highway maintenance.

BASIC SOIL EROSION FACTORS

Knowing what basic factors influence soil erosion is, of course, important in arriving at solutions. These factors are concisely listed in a paper by A. W. Johnson (9) and reproduced herein as Figure 18. And, again, special attention is called to the two bibliographies published by the Highway Research Board (10, 11). The references listed in these bibliographies offer pertinent information on the many facets of erosion control methods and practices in much greater detail than is possible here.

REFERENCES

- 1 Roadside Vegetative Cover—Final Report. New York State Dept of Public Works, 1955
- 2 McKee, W. H., Jr., Blaser, R. E., and Barkley, D. G. Mulches for Steep Cut Slopes. Highway Research Record No. 53, pp. 35-42, 1963
- 3 Barkley, D. G. The Influence of Mulches on Microclimate and Seedling Establishment on Turf. M.S. thesis, Virginia Polytechnic Institute, 1963
- 4 Button, E. F., and Porharst, K. Comparison of Mulch Materials for Turf Establishment. Jour. Soil and Water Conservation 1962, pp. 116-169
- 5 Blaser, R. E. Soil Mulches for Grassing. HRB Roadside Development 1962, pp. 15-20
- 6 Richardson, E. C., and Diseker, E. G. Control of Roadbank Erosion in Southern Piedmont. Agron. Jour., pp. 292-294, 1961
- 7 Blaser, R. E., and Ward, C. Y. Seeding Highway Slopes as Influenced by Lime, Fertilizer, and Adaptation of Species. HRB Roadside Development 1958, pp. 21-39
- 8 Brant, Frank H. Mulching Practices and Materials. HRB Roadside Development 1961, pp. 24-35
- 9 Johnson, A. W. Erosion Control Along America's Highways. Paper prepared for Golden Anniversary Meeting, Amer. Soc. of Agricultural Eng'rs, East Lansing, Mich., June 24, 1957
- 10 Roadside Development. A Selected Bibliography. Highway Research Board Bibliography 26, pp. 11-17, 1960
- 11 Bibliography on Roadside Development and Beautification. Highway Research Board, pp. 10-14, 1965

LANDSCAPE PLANTINGS

CAREFULLY planned and executed landscape plantings along a highway make significant contributions to both aesthetics and to the motorist's safety. Because of this important role, landscape plantings are virtually indispensable to the creation of the "Complete Highway."

Highway planting has gone through a period of transition—transition in both the types of plants used and their purposes. Not many years ago, the planting of many varieties of trees, shrubs and flowers was in vogue, creating costly maintenance problems in many states. These plantings were neglected and gradually disappeared. As time passed, though, the experience and the skills of trained landscape architects and engineers began to be employed until today functional and aesthetic plantings are now an important and lasting element of the total highway environment.

PLANNING AND DESIGN OF LANDSCAPE PLANTINGS

Plants scattered haphazardly over the roadside add neither beauty nor safety, but instead merely create maintenance headaches. Carefully developed design is obviously the key to successful highway planting. Plantings should be planned objectively on a broad scale before consideration is given as to actual kinds of plants to be used (1). Their composition should be pleasing and coordinated with the total highway environment and the design should be functional and aesthetically satisfying, with safety being the most important consideration.

Template design should not be used because of the tendency to increase monotony and driver tension. On the other hand, imaginative design and the skillful use of plant materials will provide interest and anticipation for the driver and his passengers.

As the motorist drives along the highway, he should be able to view complete pictures and changing scenes in scale with the speed he is traveling. Highway plantings therefore need to be dynamic in design so that the motorist will be conscious of them and appreciate them as he travels through a given area. Widely spaced plantings of individual trees or shrubs create a spotty and disturbing effect. Massed plantings are the form and texture of the landscape viewed at expressway speeds. Plantings should be set back from the traveled lanes not only for safety, but also to insure spatial continuity and the strong visual effect of a wide turf area between pavement and plantings. Generous sight distance must be maintained at all times (2, 3).

Plantings tend to emphasize or minimize existing conditions. Good planting design will emphasize and focus attention, as well as screen or conceal. For example, emphasis is given to directional changes by delineation plantings which aid a driver's decision by making it easier for him to discern the outline of a curved roadway. The effect of unsightly features may be minimized by screening or scale-defining plantings. Long stretches of guardrail or concrete drainage can be minimized to visual insignificance by a few properly placed trees (4).

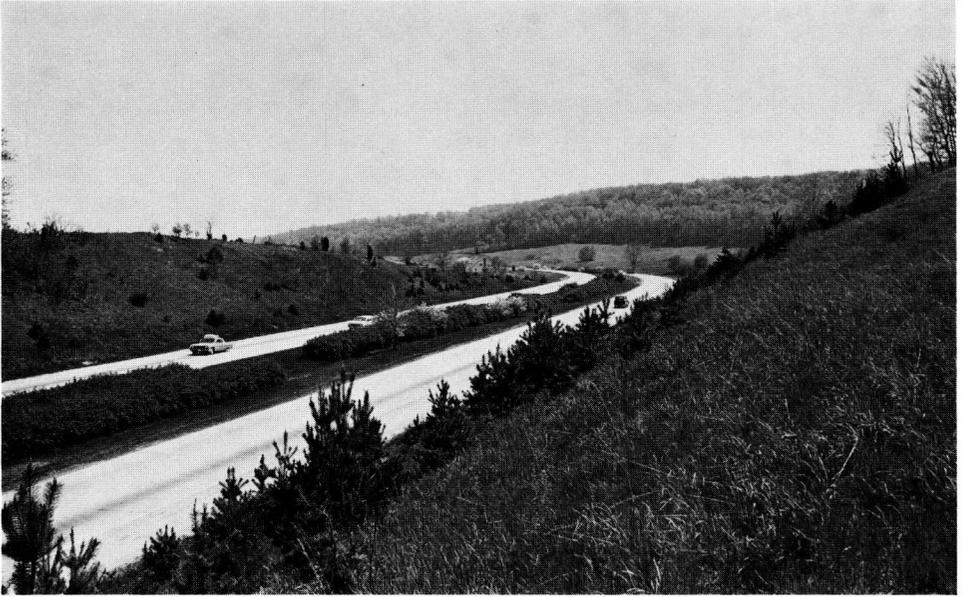


Figure 19. This stretch of highway illustrates the proper blending of carefully planned landscape planting with the natural surroundings. The median plantings are especially effective aesthetically and they also screen headlight glare.

The steepness of a cut slope may be accentuated by using vertical plant forms, or minimized by using horizontal plant forms and design patterns. The skillful design of a fill-slope planting may create a psychological feeling that the degree of steepness is less, and therefore less alarming to the motorist.

A feeling of scale is important in planting design. It can be created by using combinations of large and small plant materials, proportional in size, when mature, to the natural landscape forms and highway structures.

Planting plans should indicate type of adjacent land use, topographic features such as slope limits, and utility installations, in addition to the location of plants, species, sizes, and area of occupancy at maturity. A carefully conceived design and well-delineated plan cannot be over-emphasized.

MAINTENANCE

Ever-present in the planting designer's mind should be the problems of roadside maintenance. Mowing and herbicide operations can be made easier by arranging plantings in mass so that equipment can operate effectively (5). Plant bed outlines adjacent to the mowed areas should be flowing in order to favor maintenance.



Figure 20. Roadside plantings here serve as an effective screen, as well as adding interest to the landscape itself.

The plant material used must be able to develop properly with a minimum of maintenance under the soil, atmospheric, and climatic conditions of the area. At the same time, the plants must be the right type to fulfill the function for which they are planned. This of course, requires a thorough knowledge of plants and highway planting design.

The designer should study existing plant growth in the vicinity of the project and consider it in terms of the development of a planting scheme. Advantage should be taken of, and special attention given to, the seasonal effect of bark, fruit, flowers and foliage colors. Foliage, branching habit, and size at maturity are the most important qualities to consider in selecting plants. *Garden annuals and perennials should not be planted along highways because of the excessive cost of maintaining them under highway conditions.* Wild flowers, on the other hand, may



Figure 21. The highway plantings shown here provide attractive groundcover, and screen headlight glare of oncoming vehicles.

be encouraged to grow where mowing and herbicide operations are not limiting factors.

In certain areas the public demand for year around bare pavement requires the use of salts for ice removal. Delicate plants will not survive in soils contaminated by such salts, and obviously should not be placed near the traveled way.

FUNCTIONAL ADVANTAGES OF HIGHWAY PLANTINGS

Highway plantings have numerous functional advantages. They can make significant contributions to greater highway safety and the reduction of maintenance costs.

For example, plantings can be used to screen headlight glare, to assist driver guidance, to control drifting snow, and to provide a visual screen and partial sound barrier between the highway and adjacent areas (6).

Blurred vision is often a cause of accidents. Careful design, proper selection of species, and adequate maintenance can eliminate the hazardous and sometimes blinding effect of the headlight glare of on-coming traffic on curves and in critical interchange areas.

The designer should thoroughly understand the causes of snow drifting and

should consider them not only in designing plantings specifically for snow control, but also when designing other plantings (7).

Vegetation, too, makes highways more attractive, which in turn can enhance adjacent property values. A tree along the highway may be just as valuable, or possess even greater value, than a tree on private property (3). On the other hand, a tree too near a pavement is a definite potential safety hazard.

In an effort to solve practical problems, the effect of plant materials as a design element should not be overlooked in integrating the highway with its environment (8). Functional plantings can also be artistic creations. By applying sound landscape design principles, the functional and the aesthetic can be blended to produce safer and more pleasant highways (9).

PLANTINGS AND THE URBAN HIGHWAY

The environment through which a highway passes should dictate the planting design and the type of plant material used. A resolution passed by the legislature of California states “. . . that the appearance of freeways and other highways, and that their design and landscaping when in keeping with the immediate surroundings, especially in metropolitan areas, are major factors in their acceptance by the public in the affected communities”

Appropriate planting can go a long way toward dispelling the animosity which often flares up over the location of urban freeways. It may restore, and frequently improves, the beauty of the expressway right-of-way. The expressway should reflect the character of attractive communities. Informal plantings of

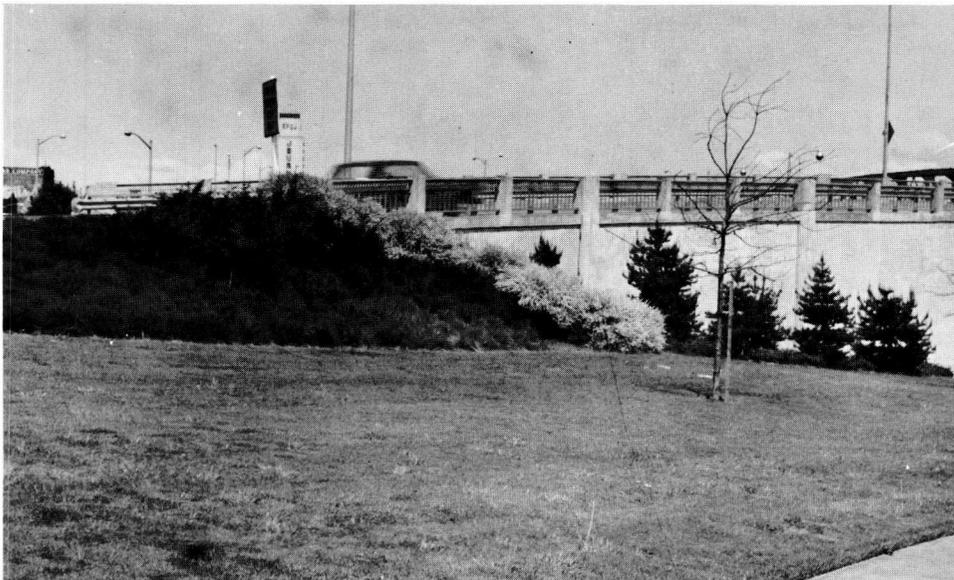


Figure 22. This well-designed planting offers a pleasing transition between the structure and its environment.

deciduous and coniferous trees, shrubs, and vines provides a green buffer strip between the travelway and adjacent urban development. Plantings of this type help to reduce traffic noise and screen dust, fumes and glare. Obviously, an immediately effective buffer requires large plants and this is expensive. However, the psychological effect of proper planting even when small material is used can be very satisfactory. The public appreciates sincerity of purpose and is usually willing to wait for nature to do the rest (10). Buffer plantings between the motorist and the community provide desirable economic and social benefits which continue for many years.

In general, plants of larger size should be used in urban areas to give a more immediate effect. A small percentage of trees as large as 5 to 6 inches in caliper may be warranted. The selection of suitable species is a major importance and should be based on experience in similar situations.

On small, steep slopes where it is difficult to maintain grass, woody groundcovers may be more economical to maintain and more pleasing in appearance than turf (11). Bridge structures and walls can be enhanced by properly locating trees, shrubs, groundcover or vines. And in urban areas, mass planting design with breadth of scale is dictated by the speed and volume of traffic which requires the constant attention of drivers.

PLANTINGS AND THE RURAL HIGHWAY

The design of rural highway plantings should not be geometric, nor need it contain only existing natural species, but it should result in a balance of the natural and man-made environment. Plantings in rural areas should be limited. Through extended stretches of open country, plantings of shade, flowering, and evergreen trees should be used to add interest, frame interesting views, and relieve monotony.

Along rural roads in the snowbelt states, plantings to control drifting snow improve with age, enhance the roadside, and may also help in driver guidance. Every effort should be made with such plantings to achieve a harmonious relationship with the existing informal environment.

The designer may wish to indicate certain areas on the plan on which mowing should not be performed. If this is done intelligently, the regeneration of native growth will be encouraged and a natural blending with surrounding areas will take place. Native growth is frequently desirable in areas which are difficult to mow, and there is no need to dictate what is to grow. This form of "naturalization" can be hastened and guided by the use of seedlings. Occasional trees related to the mass can be planted in adjacent grass areas to give scale and balance to the design (12).

SPECIAL CONDITIONS FOR HIGHWAY PLANTING

Special conditions and special areas dictate different planting treatments, each with distinctive problems of design, construction and maintenance. For example, low rainfall coupled with extreme variations of elevations and geology are special conditions found in such states as Arizona, Texas, New Mexico, Utah and Colorado. Roadside design problems usually begin and end with the proper

selection of plant material. A thorough knowledge of plant material and the ecology of the planting site is necessary for a successful planting (13).

Roadside rest areas and scenic overlooks are also special areas for planting. In these areas planting should be kept simple, serving only partially to screen sanitary facilities, provide safety and augment existing vegetation. In such areas, too, trees may be needed for immediate or future shade. In some situations, shrubs or hedges may be needed to discourage people from wandering into traffic areas that could be hazardous. Hedges that require regular pruning should be avoided. When plants used for hedges reach maturity they should have attained the desired height. Care should be taken to select plants that will require a minimum of care after they are once established (14).

Highway planting is normally performed by contract or by state forces. Some highway departments also perform plantings in cooperation with civic groups, garden clubs, or other governmental agencies. For example, Maryland has a policy whereby a particular group pays for the plants and the highway department designs, installs, and maintains the planting. The sponsoring group is not allowed to install these plantings because of traffic and worker-safety considerations. Co-operative plantings of this type have created excellent public relations throughout the state (15).

Highway plantings are no better than the plants used and the methods employed to plant them. First-line quality plants must be obtained and the latest and best planting techniques must be used. Generous pit sizes, fertile backfill mixtures, proper installation methods, and adequate water and mulch are important. After the plants are installed they must not only survive, but they must also do well with a minimum amount of maintenance under the existing roadside conditions. Planting contracts should include an establishment period of at least one full growing season.

Following proper installation, plantings must be maintained. The maintenance function is of prime importance and funds must be budgeted for this work. The first few years are the most important. Growth should be stimulated with necessary water and fertilizer so as to lessen the time required for plants to reach optimum size and density. This results in reduced maintenance costs. In addition to watering and fertilizing, weeds must be controlled either by hand or with chemicals. Other cultural practices such as insect control, pruning, and replacements must also be provided as required.

We are in a period of accelerated highway development and, more than ever before, comprehensive landscaping must be an integral part of complete highway development.

REFERENCES

- 1 Simonson, W. H. Functional Landscape Development and Planting of Highways. 50th Annual Mtg., AASHO, 1964.
- 2 Perkins, Ernest T., and Stelling, A. Carl. Safety, Health, and Welfare Through Roadside Development. HRB Roadside Development 1957, pp. 33-44.
- 4 Anderson, C. R. Proper Interchange Planting Design—Rural Areas. 50th Annual Mtg., AASHO, 1964.
- 3 Planning and Management of Roadside Vegetation—An Analysis of Principles. Highway Research Board Spec. Rept. 23, 1956.

- 5 Anderson, C R Design the President's Highway Aesthetics Program with Maintenance in Mind AHONAS Annual Convention, 1965
- 6 Ryan, J J Functional Planting on the Interstate System and Cost Analysis AASHO, 47th Annual Convention, 1961
7. Hunter, W Gordon Role of Roadway Planting Design in Control of Drifting Snow HRB Roadside Development 1962, pp 23-31
- 8 Wilson, Wayne What Plant Material Should Do as Highway Planting Proc Ohio Short Course on Roadside Development, Ohio State Univ , pp 12-15, 1956
- 9 Walker, Robert T Preliminary Report on Landscape Design Factors and Their Influence on Highway Safety HRB Roadside Development 1961, pp 49-53
- 10 Iurka, H H , Toth, John F, and Tuttle, Walter S Design of Urban Highway Landscaping HRB Roadside Development 1959, pp 3-13.
11. Deakin, Oliver A Planting the Expressway in Urban Communities Proc Ohio Short Course on Roadside Development, Ohio State Univ , pp 60-63, 1962
- 12 Deakin, Oliver A Design of Rural Highway Landscaping HRB Roadside Development 1959, pp 15-18
- 13 Earley, W O Native Plant Material for Roadside Planting as Used in Arizona Proc Ohio Short Course on Roadside Development, Ohio State Univ , p 11, 1963 —also—Monteith, John, Jr , Planting in Semi-Arid Regions in the United States HRB Roadside Development 1960, pp 14-15
- 14 Garmhausen, W J Ohio Department of Highways Builds Easy Maintenance into Its Roadside Rest Areas *Better Roads*, pp 16-18, May 1965
15. Netherton, Ross D, and Markham, Marion Legal Authority and Methods Part I HRB, Roadside Development and Beautification, 1965

ROADSIDE REST AREAS

ROADSIDE rest areas or parks, as we know them today, are a modern innovation, but they have roots in the past. Like the watering places along the ancient caravan routes, these rest areas are often eagerly anticipated by the tired traveler as an ideal place to stop and relax. Today's roadside rest areas are built solely in the public interest and are available without charge to those who care to make use of them. They are an important part of roadside development.

BRIEF HISTORY OF REST AREAS

Roadside rest areas were originally built along our Nation's highways as an occasional experiment. Their initial purpose was to give the weary motorist an opportunity to pull out of traffic for a few moments' rest and relaxation. Since then, however, the public's acceptance of this concept has been responsible for the development of much more elaborate facilities.

Most of the earlier roadside rest areas were located in rural areas, were an acre or two in size, and accommodated about fifteen automobiles. No two areas were identical but all had much in common. They offered shade, picnic tables, drinking water, and often toilet facilities. Today, the existing roadside rest areas often are not large enough to provide adequately for the traffic on our primary and limited-access roads and they are being increased in size to accommodate the demand for them. Surveys reveal that they will probably have to be increased in size again in the very near future. Newly constructed rest areas or roadside parks, such as those being placed along the Interstate System, are being designed to meet the needs of the future.

It should be noted that as the Interstate System becomes more fully developed, service facilities are rapidly appearing along intersecting roads and will augment the rest areas provided on the highway itself.

MAINTENANCE OF REST AREAS

Maintenance of Interstate rest areas is different from that given those on other roads due not only to the great increase in the number of person using the areas, but also because the area is used both day and night. It has therefore been necessary for the designers to incorporate special measures to permit easy maintenance. Each maintenance task must be analyzed to determine whether it can be done more effectively by hand or with power-equipment.



Figure 23. A rest area of good design on an Interstate Highway—Juneau County, Wisconsin.

Increased use of the roadside rests of course means that more refuse will accumulate. Research proves that the most economical way to dispose of this material is to burn it in the park in specially designed incinerators.

Although bare pavement maintenance is not as important on interior roadside rest areas as on roadways proper, snow and ice removal from the parking lots, ramps and sidewalks should be prompt and so organized that it will coincide with the snow removal schedule for the roadways. This adds immeasurably to the convenience and safety of the public. Excessive salt should not be used because of the harmful effects it has on the adjacent vegetation.

The caretaker is a key person in any roadside rest area program. He should be employed on a full-time basis and have no other duties to perform. The work of mowing grass and emptying refuse cans is important and determines the appearance of the park, but of more importance is keeping the toilets clean and insects under control. To accomplish this, the caretaker should know proper sanitation measures and then be furnished with the necessary tools and supplies to do the job.

If the roadside rest has vault toilets, specific instructions must be given to guide the proper use of chemicals to control odors. If the toilet is a water-flush type the caretaker must be aware of how to maintain the disposal unit. In most cases good housecleaning practices will insure satisfactorily maintained toilets.



Figure 24. A family vacationing by automobile takes a "safety break" by having their lunch in the pleasant surroundings of this attractive roadside rest area. Note the well-designed drinking fountain shelter. Rest rooms may be seen behind it.



Figure 25. Here is a rest area bulletin board giving the motorist important map information.

Careful cooperation with the state department of health results in safe drinking water, sanitation and control of insects at all parks. The caretaker will need the help of a floating crew to keep the area mowed and to make minor repairs. He should have quick access to police assistance when needed, in addition to regular police patrol visits.

PLANNING ROADSIDE REST AREAS

Roadside rest areas present new problems and it is always well to take a fresh look at procedures. A firm policy should be adopted and approved before designing the area in order that preventive maintenance measures can be incorporated into the construction plans

Legislation should be enacted which allows the highway department to purchase sites for efficient roadside rests of modern design. Location, purchase and development of these areas fall under general highway construction. The spacing of roadside rests should conform to a statewide master plan, and they should be selected so as to take advantage of natural topography and scenic qualities. Necessary land which is outside normal right-of-way width should be part of the original right-of-way purchase

Many normal rest area services include information concerning road conditions, location of other service facilities along the route, as well as the location of scenic, historic, and recreational areas. Telephones are often included.

Since roadside rests will be used not only during the daylight hours, but during the hours of darkness as well, facilities such as ramps, parking areas, shelter houses and toilets should be lighted.

The increased use of rest areas has dictated the need for water-flush toilets in the design. In some areas, the design will also have to include heating the building. Construction of these buildings should be of material that will require the least amount of maintenance. The inside finish should be of tile, or a good substitute, that is easy to keep clean. The design should provide not only for toilets and wash basins, but might well incorporate a drinking fountain, bulletin board, and telephone. If the design includes space for dispensing tourist travel information and an attendant is not furnished, then provision for self service must be considered.

Good design requires lumber that has been pressure-treated with pentachlorophenol. All tables, grills, serving tables and refuse cans should be placed on concrete slabs.

Hard surfaced shoulders on ramps provide for overflow truck parking. Curbing outlining the parking area eliminates the use of posts and rails.

Side slopes that are mowed should be no steeper than three on one. Erosion control assumes important proportions on the large areas now demanded, so all areas should be covered with vegetation and all slopes streamlined to facilitate the use of maintenance equipment.

Grass seed mixtures should consist of species that will tolerate moderate pedestrian traffic. Plantings should be used only to screen partially toilets and other structures, and to augment existing vegetation. Trees may be needed for



Figure 26. Examples of modern comfort structures in rest areas: (a) Wisconsin and (b) Virginia.



Figure 27. In rest areas where adequate natural shade is unavailable, an attractive picnic shelter such as this can be used to great advantage.

additional future shade, while shrubs, or hedges can be used to discourage visitors from walking into areas that may be dangerous. Buffer plantings should adequately screen adjacent developments.

Rest areas, well-designed and well-placed, are without question an important adjunct to the "Complete Highway." They add to safety as well as to beauty on the road. As more and more traveling is done on the rapidly growing Interstate System, such rest and relaxation will take on even more importance. Interstate Highway driving is often long-haul driving that can produce fatigue through monotony and eyestrain. The rest areas along these highways can obviously make significant contributions to the safety of the driver and his passengers. In short, rest areas add immeasurably to the ability of our highway system to serve fully the motoring public.

REFERENCES

1. Eckert, Edward C. A Concept for Interstate Rest Areas. Highway Research Record 23, pp. 42-46, 1963.
2. Poorman, F. S., and Chamberlin, R. E. Suggested Activities for Future Roadside Development Research. Highway Research Record 23, pp. 39-41, 1963.
3. Garmhausen, Wilbur J. Roadside Rest Requirements on the Interstate Highways. HRB Roadside Development 1962, pp. 40-44.
4. Head, J. A. Use of Safety Rest Areas. HRB Proc., Vol. 41, pp. 375-414, 1962.
5. Garmhausen, Wilbur J. Roadside Parks on Limited-Access Highways. HRB Roadside Development 1956, pp. 57-60.
6. AASHO. A Policy on Safety Rest Areas for the National System of Interstate and Defense Highways. Committee on Planning and Design Policies. 1958. 42 pp.

SCENIC TURNOUTS AND OVERLOOKS

SCENIC turnouts and overlooks are areas lying adjacent to highways where organized parking and viewing accommodations have been constructed for use by the motoring public. From these locations an attraction of unusual significance or beauty may be enjoyed from a safe vantage point. It may be a distant body of water, a spectacular mountain view, a beautiful river or valley or some similar outstanding attraction warranting special consideration.

While it is customary to associate these attractions with a rural or wilderness setting, there are many opportunities for the installation of such improvements in an urban environment, too. These areas can be the “extras” found along the way which distinguish an excellent, planned highway from a merely functional one. They can convey a philosophy that highways are more than a series of bridge structures connected by vast stretches of pavement.

SELECTING THE SITE

Usually the site selected for a turnout will represent a climax point along a particular section of highway. It will be from this vantage point that the view is most outstanding

In selecting a scenic lookout site, consideration should be given to locating the facility far enough away from interchange points so that traffic conflict can be avoided. The selected location should also afford traffic approaching the area maximum sight distance. This, of course, gives the driver adequate decision time.

It is also important that the design of the exit road be such that the driver wishing to return to the highway has an adequate view of approaching traffic.

Normally, scenic overlooks are less completely equipped than rest areas or roadside parks. Picnic tables are sometimes provided, but toilets and drinking water usually are not. The size of the overlook is also somewhat smaller than that of the rest area. However, the average-sized scenic turnout should be large enough to protect it from encroachment and insure adequate operating room to protect both nearby and distant views. It is particularly important that thought be given to future contingencies which may obstruct the view from the turnout site.

Often existing trees growing on land adjacent to a lookout will develop to a size where the tree crown will completely obscure the scenic attraction beyond. Future developments on adjacent land may also create unsightly conditions. A

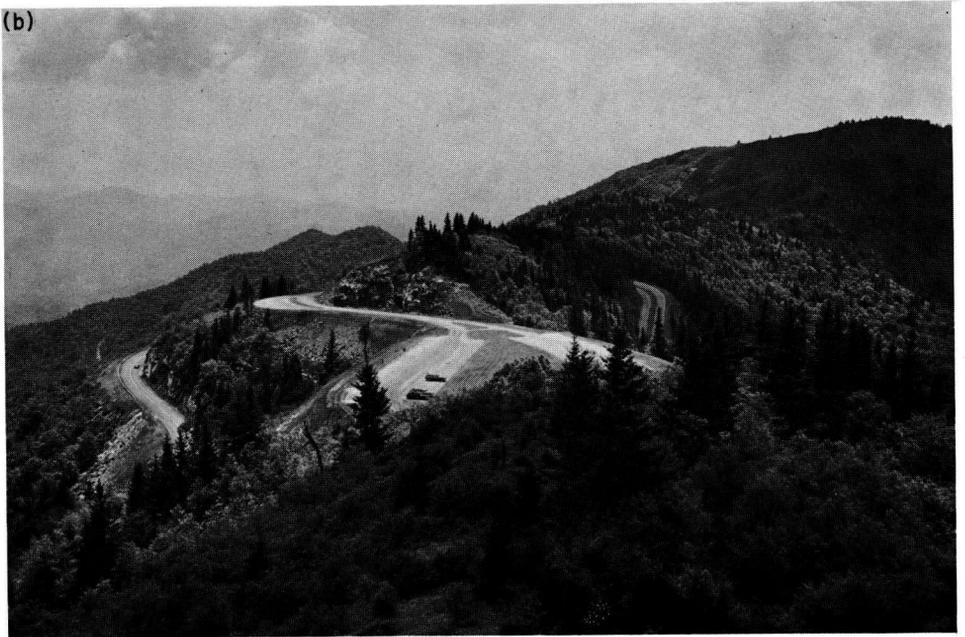


Figure 28. Waterrock Knob overlook in North Carolina: (a) view of the immediate site, and (b) view from a higher elevation showing spectacular terrain surrounding it.

buffer strip of reasonable width around the margin of the turnout site can often prove to be a wise investment.

IMPORTANT COMPONENTS OF THE SCENIC OVERLOOK

The parking area of a scenic overlook normally need be designed only for passenger cars and cars with trailers. Space for trucks should not be necessary. The shape of the turnout will normally be rectangular with the long axis parallel to the main highway. A depth dimension perpendicular to the main highway



Figure 29. A scenic overlook along the Blue Ridge Parkway in North Carolina.

should be based on the existing topography and be chosen where site contour suggests. The parking area should be designed for both angle and parallel parking to accommodate cars with trailers in a parallel parking pattern. Telephone service may also be desirable.

Normally the attraction will be most impressive during daytime hours although in the case of scenic overlooks in urban areas there is abundant opportunity to feature nighttime views. When nighttime use is anticipated, grounds lighting should be included for safety purposes.

Viewing structures such as towers normally should not be installed since they require considerable maintenance and may be the cause of accidents leading to lawsuits. Proper advance signing should be installed along the highway to

let the public know that the scenic turnout is ahead. Such signing should be placed far enough in advance of the turnout to discourage shoulder parking. This is particularly important when the route passes along a section of highway having scenic qualities for an extended distance.

In situations where an interior driveway system is necessary this should be constructed so there will be no great difficulty in reaching the climax viewing point in the lookout interior. Grades of 6 to 8 percent are reasonable for cars with trailers.

An information sign at the site identifying the particular scenic feature being viewed is always welcomed by the public. A pedestal-mounted compass-style



Figure 30. Mt. Le Conte from Maloney Point overlook, near Gatlinburg, Tenn.

orientation disc of adequate size, to which small arrows are attached pointing to named scenic objects, can be a helpful item where more than one attraction is visible. An identified location from which pictures may be taken will also be appreciated.

In most cases, scenic lookouts are operated on a seasonal basis. The area should be graded and landscaped so that it will lend itself to economical maintenance. A few well-positioned shade trees and a well-maintained lawn area are the basic ingredients for these types of areas. Slope surfaces flattened to a mini-



Figure 31. An overlook along the George Washington Memorial Parkway in Northern Virginia near Washington, D. C.

mum of 1 on 6 and molded into the adjacent area will create an overall pleasing appearance. A sturdy barrier wall or fence should be erected along the top of escarpments as a protection for children at locations having major interior elevation changes. Such barriers should be constructed of local material.

Footpaths may be desirable in cases where the attraction can be viewed at close range. Either shredded bark or woodchips are a particularly appropriate material for such walks. Should a small stream be an included feature, a rustic footbridge would be a nice touch as part of the interior footpath system. Rustic benches are welcome along pathways which are of some length or steepness. An adequate number of refuse barrels should be placed strategically throughout the area to aid in keeping the grounds clean. Further signs should be placed informing the public that pets must be on a leash when out of cars. Signs indicating an exercise area for pets should be posted at conspicuous locations.

From an administrative standpoint, it is best to number or in some manner identify areas such as scenic turnouts. In cases of emergency this can be very advantageous.

Maintenance of the area should be thorough and frequent. Any neglect insofar as adequate care of such areas is concerned is reflected in misuse by the general public.

REFERENCES

- 1 Gordon, George B Parking Turnout and Wayside Areas (A progress report by the subcommittee on Parking Turnouts and Rest Areas). HRB Roadside Development 1950, pp 66-93.
2. Parking Turnouts and Rest Areas Highway Research Board Spec Rept 7, 1952
3. Selective Cutting of Roadside Vegetation for Improved Highway Safety, Appearance, and Use Highway Research Board Spec Rept 43, 1959
4. Disque, Earl A , Moderator Symposium on Parkway Concepts and Principles HRB Roadside Development 1961, pp. 59-76.

SAFETY IN ROADSIDE DEVELOPMENT

THE “Complete Highway” provides safety, utility, economy, and aesthetics through proper planning, location design, construction, and maintenance. Safety is very definitely a composite part and it is brought about through the interpretation and application of knowledge. It is a science, but is kindred to the arts. Thus, a functional highway can be of considerable aesthetic value and be a safe highway as well.

The need for safety need not be belabored. Suffice it to say that it is important that programs for the construction of new roads or the improvement of existing roads include considerations for safety not only in the traffic flow, but in the roadside development as well, and such considerations must, of course, reflect the man’s behavior in his use of highways.

Roadside design factors which significantly influence highway safety are as follows (1):

1. Conservation of natural landscape features in highway location,
2. Cross-section design and right-of-way width;
3. Planting designs; and
4. Development of rest areas and other special sites

And location and design considerations which conserve and promote natural landscape features can affect safety by (a) reducing headlight glare, (b) guiding traffic movements, (c) controlling erosion, and (d) serving as a cushion barrier.

The long, easy movement of curvilinear alignment adds driver interest and tends to counter the deadly effect of hypnosis caused by monotony. Profiles with easy grades that fit the topography relieve the motorist of the need to be concerned with changing speeds. The grades flow through the terrain in a manner that creates interest and reduces tension. And ample sight distance is provided so that emergency stops may be avoided. Divided highways planned as separate one-way roads use terrain, shrubbery or other selected plantings to promote safe and relaxed driving.

A relationship of the vertical and horizontal elements of the highway’s cross-section should reflect existing conditions of terrain. An out-of-control vehicle is damaged less on an easy slope than on a sharp one. Flat slopes in the “snow states” interpose less interference with wind movements and tend to simplify hazardous snow drifting control.

As has been mentioned, effective planting can reduce headlight glare, define

turning movements, delineate curves, screen distracting vehicular movements, control slope erosion, reduce maintenance operations, and function as a cushion barrier and a "snow fence."

Roadside areas developed for motorists' use for rest, relaxation, and viewing the countryside are important to safe driver operations. Since driver fatigue and tension are related closely to the manner in which drivers react, it is essential that adequate provisions be made for stopping and resting. Rest areas should be designed with adequate comfort and convenience facilities to encourage proper and frequent use of such special areas.

PLANNING AND SAFETY

Highway planning is the thought that not only precedes construction, but that continues from project inception to project completion. Planning begins as the first meanderings of soft pencil on topographic maps take place—and it is at this time that much is either won or lost in the battle for a balanced aesthetic and safe highway

The location planner must be concerned with and have an interest in the conservation of land forms and bodies of water, and the inclusion of valuable landscape features. And he must be equally concerned with the preservation of our cultural, historical and recreational areas. The planner must see beyond the three dimensions, he must give thought to time and the seasons of the year, to areas of sun and shade, to the effects of crosswinds, to the appearance of structures and to textural contrast and color. All of these things are important to the evolvement of line and grade if the highway is to fit the land and belong to it. The vertical profile must be successfully matched with the horizontal alignment to assure their functional integration. Extensive cuts and fills occur, and are unavoidable, but in the interest of safety much can be done to make them less severe through greater attention to slope rounding, more variation to slope ratios and to slope limits. Cuts frequently can lose much of their rigid vertical impact by sufficient width of grass shelf beyond the shoulder limits. Greater collaborative effort between planning and design will result in a highway that has built-in safety features.

DESIGN AND SAFETY

Where the planner leaves off, the designer begins. He enters into an area of development and refinement that can either enhance the planner's work or can tarnish it. The designer's final line, grade, and cross-sections will play a critical role in erosion control, snow drifting onto pavement and shoulders, and surface and subsurface runoff. Slopes must be more varied and be allowed to conform more to the existing ground than the grid-oriented triangle of the template-maker. Slope rounding is too frequently a token gesture rather than an actual attempt at moulding the cleavage of two intersecting planes.

The AASHO Policy on Landscape development offers guidance on minimum distances of trees from traffic lanes. This policy is based in part on work done at the General Motors Proving Ground (2)

Studies have also clearly shown significant safety advantages in designing and maintaining shallow-edge drainage ditches. Suggested design criteria for the widths, depths, and limiting side slopes for ditches, all related to design highway speeds, were reported to the Board through the Committee on Geometric Highway Design and have been published.

The treatment of the cross-section has a distinct bearing on safety as it is related to sight and sound. Slopes can do much to screen the view and traffic noise of a highway from adjoining properties. Depressions and/or mounds cannot only improve drainage, they can deflect sound and deflect straying vehicles from crossing the median. Gentle earthen slopes and berms can not only support natural growth, but also serve as vital vehicle decelerators, reducing the need for more costly fencing or railing. Effective sloping with appropriate planting can serve to screen annoying headlight glare. Sloping, too, can open shaded areas to the sun and hasten thawing on an icy highway section. Certainly the work of the designer far transcends the surface limits of the highway right-of-way.

CONSTRUCTION AND SAFETY

Thought and action in the earliest stages of highway construction are necessary to assure built-in safety. Slope limits may appear on plans and cross-sections as specific lines and points of intersect, but they should be viewed as variables frequently capable of minor adjustment if improvements can be made by the action. All too frequently the clearing limits of a highway construction project are established as a fixed line or tangent for hundreds of feet in length, without the least allowance for deviation.

MAINTENANCE AND SAFETY

The concern with the planning, design, and construction of a highway has too frequently minimized the importance of maintenance. Not long ago maintenance of some of our rural highways was limited to the infrequent surface treatment of the pavement. Today roadsides, too, are an important aspect of maintenance operations.

Roadsides require effective management of vegetation. Grass needs mowing and trees need pruning to provide adequate sight distance. Roadside maintenance is essential to a safe highway system. The next chapter discusses this in some detail.

SUMMARY

Those responsible for roadside development in any highway organization have as their role and responsibility the proper and efficient management of the right-of-way. The roadside is many things. It is acres and square miles, ground cover and forests; streams, rivers, lakes and ponds. It is roadside drainage, slopes, walls, barriers and fencing. It is turf plantings, orchards, and wildflowers. The roadside is picnic areas, rest stops, and scenic views. It is that essential area that both separates and unites the highway with its environs.

The view that the motorist sees from the road—both near and far—should be something of value to enjoy and preserve. To conserve the roadside is to demonstrate that every element of aesthetic worth is an enhancement to the safety of the roadway. The collaborative efforts of the engineer and the landscape architect in the planning, design, construction and maintenance of our highways results in safer, more utilitarian, and more aesthetic highways.

REFERENCES

- 1 Walker, Robert T. Preliminary Report on Landscape Design Factors and Their Influence on Highway Safety. HRB Roadside Development 1961, pp 49-53
- 2 Stonex, K. A. Roadside Design for Safety. HRB *Proc.*, Vol 39, pp 120-156, 1960

MAINTENANCE

THE maintenance of roadside areas along today's controlled-access highways and other primary arterial roads calls for practices that will contribute to a pleasing environment, that are conducive to safety, and that are economical.

A BRIEF HISTORY OF ROADSIDE MAINTENANCE

Before 1940, most American highways had just enough right-of-way to embrace a single roadway, V-shaped ditch sections, and space for 1:1 slopes. If additional width was taken, the adjacent land owners commonly used it for the same purposes as the abutting property. Under such conditions, normal roadside maintenance consisted merely of mowing, several times a year, the narrow strip separating the edge of pavement and the ditch, removing eroded material from drainage structures and ditches, cutting brush, and pruning trees.

A completely different concept is required to satisfy the needs of our modern multiple-lane, divided highways with rights-of-way often 300 feet or more wide and which include considerable additional acreage to accommodate frequent and complex systems of interchange ramps (1).

Completion of the 41,000 miles of the Interstate System will add more than 1,000,000 acres of roadside area to an existing total of 2,500,000 acres. Except for arid sections in the southwest, a large portion of this area will be vegetated with turf-type growth that will require some degree of maintenance to meet minimum standards of utility and aesthetics.

This information serves as a background for the following review of the four basic aspects of roadside maintenance to be discussed here (a) vegetation, (b) trees, (c) elimination of noxious plants, and (d) litter.

VEGETATION

In the several climatic regions in the United States there is a wide range of vegetation, and various turf management practices have been developed to satisfy sectional needs.

In some states there still is no recognition of principles basic to, and consonant with, the aesthetic, economic, and utilitarian requirements of extensive areas of roadside turf—a situation harking back to the sickle bar, hand scythe operations of 30 years ago. Encouraging progress, however, is being made in most regions.



Figure 32. The median strip of the highway shown here is comparatively narrow and level and is maintained through neat mowing. All the elements of this highway are blended into a utilitarian, aesthetic, and safe entity.

The requirements for maintaining turf in humid regions of the south are quite different from those essential in cool, north-central states; however, there are basic concepts of effective, maintenance management that have general applications (2).

Type

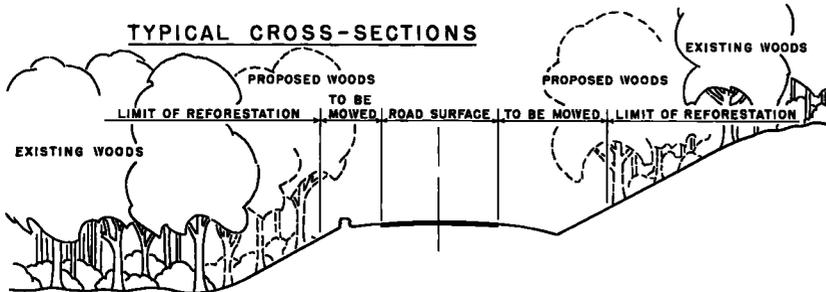
The type of vegetation and intensity of management are dictated by the character of the area. For example, urban areas and focal points such as interchanges will have a large proportion of neatly mowed turf. In many sections through rural areas the roadside beyond ditch lines, including slopes, should be permitted to revert to native woody species and herbaceous perennials.

Equipment Needs

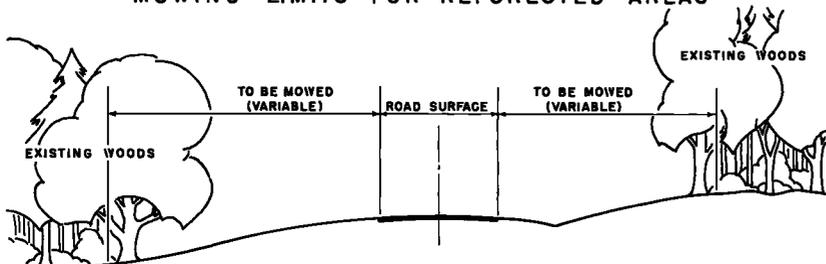
Equipment needs must be determined by cross-section characteristics. In selecting mowing equipment the following should be borne in mind:

1. Gang reels are best for median strips, interchange islands and other large areas of flat or gently sloping roadside where neat and uniform turf is desired.
2. Rotary mowers are best for less frequently mowed areas, and those with a surface too irregular to permit the use of gang reels.

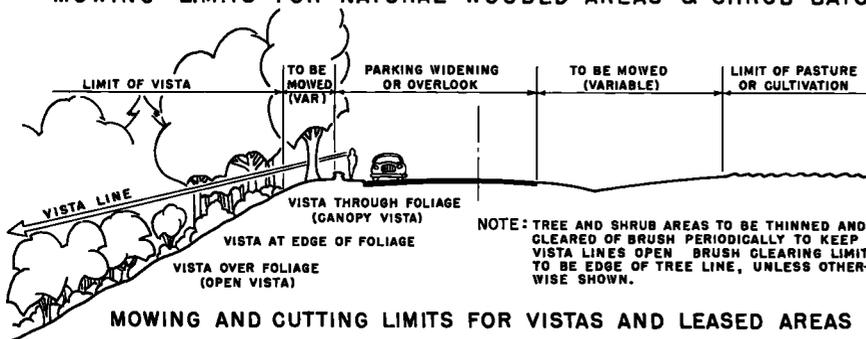
TYPICAL CROSS-SECTIONS



MOWING LIMITS FOR REFORESTED AREAS



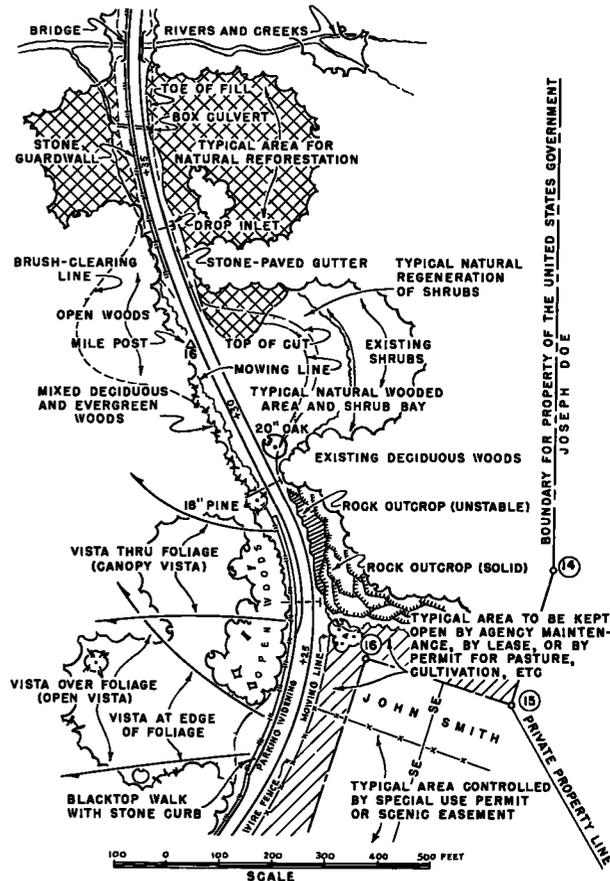
MOWING LIMITS FOR NATURAL WOODED AREAS & SHRUB BAYS



MOWING AND CUTTING LIMITS FOR VISTAS AND LEASED AREAS



PLAN INTERPRETATION



U. S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
PORTION OF PROPOSED

ROADS AND TRAILS MAINTENANCE PLAN

Figure 33. Example of a proposed maintenance plan for roads and trails.

3. Sickle bar mowing is best for infrequently mowed areas where rotary type is not suitable, *e. g.*, a large area where hay may be a useful by-product.

4. Flail (hammer knife) mowing is best for areas where growth is coarse or bushy, and where windrowing of cuttings is undesirable.

A number of states have tried contract mowing on an experimental basis; Massachusetts has adopted it as routine and reports received thus far have been favorable (3). Other states often find it economical to supplement state-owned equipment with rental equipment.

Unlimited mowing from fence-line to fence-line without considering the roadside environment cannot be justified either economically or aesthetically. Mile after mile of neatly maintained, lawn-like, roadside areas is neither distinctive nor indicative of the character of the natural environment of the state or locality the motorist views. Research has shown that mowing can sometimes displace sod on steep slopes and initiate erosion.

However, fire hazards may develop in areas where lack of mowing results in an accumulation of drying stalks and leaves in the fall of the year. This condition could cause concern during the development stage of an area intended for naturalization. If the hazard involved is sufficiently grave, such areas should be mowed with a flail-type mower in late summer or early fall (about September 1 north of the 38th parallel). This procedure will scatter the mowings and prevent

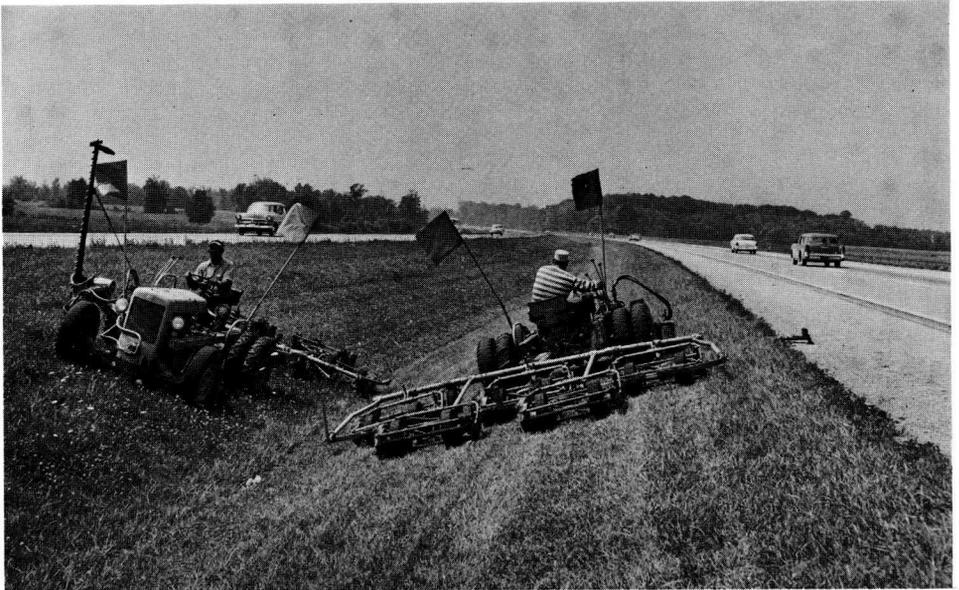


Figure 34. Effective and economical turf management can best be achieved with equipment adapted to the terrain and expertly and safely operated.

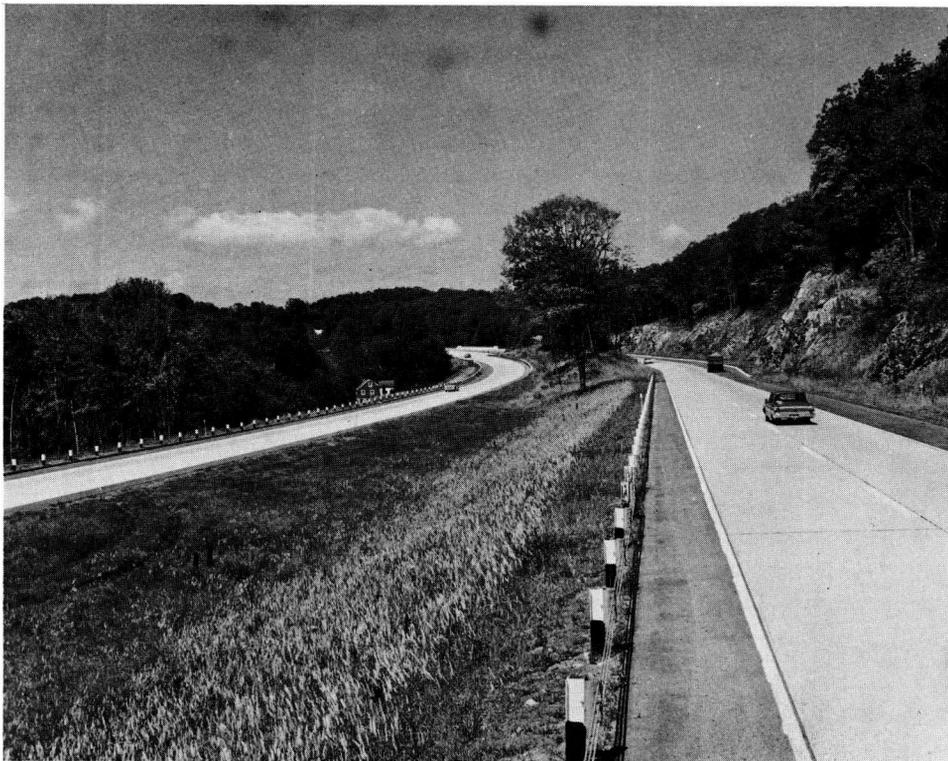


Figure 35. This photograph illustrates several facets of a really well-planned highway maintenance program. Note that the roadside areas adjacent to the woodland have not been mowed and are becoming "naturalized." The guardrail section is clean and neat appearing. The center portion of the median has not been mowed, but is weed free and "belongs" to the total environment.

the possible fire hazard and smothering effects of windrowed cuttings. Following a late summer mowing of perennial grasses there will normally be a regrowth that will be fire resistant.

Herbicides

Herbicides are an important family of chemicals that permit economical control of unwanted vegetation, and contribute to aesthetic values. The three major categories of use are as follows:

1. To control and eliminate broadleaf weeds in turf areas that are intensely maintained, and in seldom mowed areas of grass where the presence of tall-growing, broadleaf weeds would be objectionable. Ester and amine forms of 2, 4-D are the most commonly used formulations for control of this kind.
2. To control or eliminate vegetation beneath and adjacent to guardrail sections. Depending on the degree of control desired, several techniques and a number of commercial formulations are used in different states.

- a. *Sterilants* are used in some states with varying effectiveness. If the sterilants do not move too far beyond the area treated (where they may damage needed ground cover vegetation and thereby permit the start of erosion), they can serve as an effective means to eliminate all growth. In some areas an asphalt spray is applied after placing sterilants to provide a longer period of control, lessen the danger of the herbicide moving to adjoining slope surfaces, and to protect the treated strip from erosion. All the major manufacturers of herbicides produce sterilants which are effective when properly used under optimum circumstances (4)
- b. Combination of *systemic herbicides*, e.g., 2, 4-D and Dalapon, to eradicate grasses and broadleaf vegetation are also used with varying effectiveness. Time, method, and uniformity of application, species of vegetation, and soil types are factors that influence the effectiveness of this group of control agents
- c. *Contact herbicides*, such as ammonium sulfamate, phenols, sodium chlorate and several other compounds, are still used in some areas. They produce a rapid kill of all exposed plant parts and can obviously create adverse effects.

3 To inhibit the growth of grass beneath guardrail and other portions of the right-of-way where turf must be maintained at heights no greater than 8 inches (5) Retardants are being used in such cases. This chemical (maleic hydrazide) has produced excellent results in some sections, however, research projects conducted in several states have demonstrated that careful attention must be given the following factors.

- a. Time of application is important. This is difficult to accomplish in those regions where the time for effective application is limited
- b. Application must be uniform. A small area skipped or missed will detract from the appearance of an extensive area.
- c. Many broadleaf weeds resist MH, thus requiring the addition of a herbicide on those areas where a dense, high quality turf is not present.
- d. It is comparatively expensive
- e. MH used at 6 to 10 pounds per acre, in combination with 2, 4-D, may be effective and economical in eliminating mowing in difficult areas such as fence lines and beneath guardrails

Fertilization

The maintenance of an effective turf requires proper mowing, control of weed growth, and adequate fertilization. Diseases and insects are not to be discussed here because these two subjects are seldom given attention in the right-of-way.

Fertilization practices include the extremes of "we don't bother" in some states to "fertilize often—and heavily" in others. A useful common sense rule of

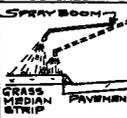
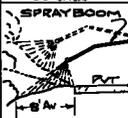
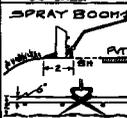
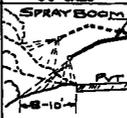
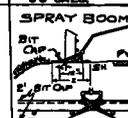
1965 CONNECTICUT STATE HIGHWAY DEPARTMENT HERBICIDE PROGRAM											
CLASSIFICATION OF TREATMENTS	WEED CONTROL INTENSIVELY MOWED AREAS (MEDIANS, ETC)	ROADSIDE APPL EARLY HERBAC WEED ELIMINATION	SEASONAL REM GRASS & WEEDS UNDER GUIDE RAILS SIGNS, ETC*	ERADICATION OF POISON IVY & POISON SUMAC	CONTROL OF RAGWEED & OTHER ANNUAL WEEDS	LATE SUMMER APPLICATION ON BRUSH REGROWTH	BASAL BARK SPRAY ON CUT BRUSH	SOIL STERILIZATION UNDER GUIDE RAIL — WITH BITUMEN COVER†	TREATMENTS ON DIFFICULT TO KILL SPECIES	SELECTIVE WEED AND GRASS ERADICATION IN SHRUB BEDS	
APPLICATION TIME	1 LATE APR - MIDDLE MAY	2 EARLY MAY - LATE MAY	3 APRIL - FIRST FROST	4 JUNE 1 - SEPT 15	5 EARLY JULY - AUGUST	6 AUGUST 15 - SEPT 15	7 FALL & WINTER	8 ANY TIME SOIL IS NOT FROZEN & NOT DURING RAIN	9 SPRING & SUMMER	10 MAY 15 - SEPTEMBER 1	
TYPE OF SPRAY	BROADCAST	BROADCAST	UNDER GUIDE RAILS	SELECTIVE	BROADCAST	SELECTIVE	SELECTIVE	UNDER GUIDE RAILS		SPOT-SELECTIVE	
MATERIALS	3QT 2,4,D AMINE & 50 LBS 12-32-12 SOL FERT 50 GALS OF WATER	3QT 2,4,D AMINE & 50LBS 12-32-12 SOL FERT 50 GALS OF WATER	10LBS RADAPON PLUS 2QT 2,4,D PLUS 2LBS SIMAZIN HANDBOOM #6504 T-JET FOR SIGNS ETC 50 GALS OF WATER	1QT 2,4,D AMINE & 1PT 2,4,5T AMINE TO 50 GALS OF WATER	2QT 2,4,D AMINE HANDBOOM IF NEEDED 850 LBS 12-32-12 SOL FERT 50 GALS OF WATER	2QTS 2,4,D & 2QTS 2,4,5T 50 GALS OF WATER BROADCAST OR HANDBOOM	HANDBOOM 1 1/2 GAL 2,4,5T L V ESTER 48 GAL #2 FUEL OIL OR KEROSENE	7 LBS SIMAZIN OR 10 LBS KARMEX (TELVAR DW) 50 GALS OF WATER	MILKWEED 1 LB AMINO TRIAZOLE / 10 GAL WATER HANDBOOM-T-JET WITH #6504 TIP THOROUGHLY WET ENTIRE PLANT, AVOID SPRAYING GRASS OR DESIRABLE VEGETATION	1/4* AMINO TRIAZOLE & 1/2* SIMAZIN / 50 GAL WATER HANDBOOM #6504 TIP	
EQUIPMENT	SMALL BEAN PUMP - CONTINUOUS BY-PASS AGITATION WHILE SPRAYING										
NOZZLE MOUNTING	2 OC-20 TIPS LEFT SIDE	2 OC-20 TIPS RIGHT SIDE	2 OC-20 TIPS RIGHT SIDE	2 T-JET #6504 TIPS HANDBOOMS	2 OC 20 TIPS RIGHT SIDE	2 T-JET #6504 HANDBOOM 2 OC 20 TIPS BROADCAST	1 T-JET #6504 TIP HANDBOOM	2 OC-20 TIPS RIGHT SIDE	CANADA THISTLE 1 LB AMINO TRIAZOLE PER 10 GALS WATER HANDBOOM-T-JET & #6504 TIP - THOROUGHLY WET ENTIRE PLANT. SPRAY IN BUDD STAGE JAPANESE BAMBOO 1 GAL BARON IN 4 GALS WATER, APPLY EARLY IN SEASON, & SOAK FOLIAGE, STEMS AND GROUND AT BASE OF PLANTS. DO NOT HIT DESIRABLE PLANTS OR GRASS HANDBOOM WITH T-JET #6504 TIP	CARE MUST BE EXERCISED NOT TO ALLOW SPRAY MATERIAL TO HIT FOLIAGE OF SHRUBS	
GAUGE PRESSURE	50 - 60 LBS	50 - 60 LBS	2 GALS / MINUTE 50 - 60 LBS	40 - 50 LBS	3 GALS / MINUTE 50 - 60 LBS	3 GALS / MINUTE 40 - 50 LBS	40 - 50 LBS	2 GALS / MINUTE 50 - 60 LBS			
TRUCK SPEED	5 MPH	5 MPH	5 MPH		3 MPH - BROADCAST	3 MPH - BROADCAST		4 - 5 MPH			
COVERAGE WIDTH	10 FEET	8 FEET	2 FT FROM EDGE OF THE SHOULDER IN UNIFORM STRAIGHT LINES	THOROUGHLY WET FOLIAGE OF VINES	8 - 10 MPH	8 FT - BROADCAST	WET STUMPS UNTIL SOLUTION RUNS DOWN TO BASE OF STUMP.	1.5 FT (FROM 6" BEHIND RAIL IN STRAIGHT LINE)		1/2 ACRE	
COVERAGE LENGTH	2 MILES	2 MILES	2 MILES		2 - 4 MILES	0.5 MILE		2 MILES			
APPLICATION RATE	50 GALS	50 GALS	50 GALS	50 GALS	50 GALS	50 GALS		50 GALS			
SKETCH OF OPERATION											
SPECIAL FEATURES & PRECAUTION	DO NOT APPLY ANY HERBICIDE IN WINDY PERIODS DO NOT APPLY 2,4,D OR 2,4,5T WHEN TEMPERATURE IS 86°F OR HIGHER DO NOT PERMIT PUMP PRESSURES WHICH WILL PRODUCE FINE DROPLETS CAUSING DRIFT AWAY FROM THE SPRAY AREA DO NOT ALLOW ANY HERBICIDE TO HIT FOLIAGE OR STEMS OF DESIRABLE VEGETATION, SHRUB PLANTINGS, ETC DO NOT UNDERTAKE A SPRAY PROGRAM UNTIL YOU THOROUGHLY UNDERSTAND ITS OBJECTIVES.					DIRECTIVE # 3 (RADAPON) * APPLY SOLUTION WITH HANDBOOM TO BASE OF STEM AND DELINEATOR POSTS UNTIL AN AREA WITH A DIAMETER OF 12" AROUND EACH POST HAS BEEN THOROUGHLY WETTED DO NOT SPRAY A LARGER AREA THAN INDICATED		DIRECTIVE # 8 T - BITUMEN CAP FOR STERILIZED SOIL UNDER GUIDE RAILS - APPLY IMMEDIATELY (SAME DAY) AFTER APPLICATION OF KARMEX (TELVAR DW) OR SIMAZIN USE MC-3 ASPHALT OR OTHER COMPARABLE BITUMEN. APPLY AT RATE OF 0.4 GAL / SQUARE YARD IN A 2 FOOT STRIP UNDER GUIDE RAILS BE SURE THE BITUMEN IS APPLIED BEHIND THE GUIDE RAIL SO THAT AN EFFECTIVE OVERLAP EXTENDS FOR 6" BEYOND THE STRIP TREATED WITH KARMEX (TELVAR DW) OR SIMAZIN. THE BITUMEN CAP SHOULD BE APPLIED NEATLY IN A UNIFORM STRAIGHT LINE BEHIND THE RAIL; AND WHITE POSTS MUST BE SUITABLY PROTECTED DURING APPLICATION TO PREVENT THEM FROM BEING SPATTERED WITH THE MATERIAL.			
CALIBRATION	PLACE BY-PASS PIPE IN SAME DRUM OF WATER AS INTAKE PIPE START PUMP ADJUST PRESSURE TO RANGE INDICATED IN THIS DIRECTIVE CLEAR AIR FROM NOZZLE LINE BY TURNING ON VALVE FOR 1/2 MINUTE BE SURE BY-PASS IS OPERATING, BUT ADJUST FOR PRESSURE WITH OUTLET (NOZZLE VALVE) SHUT OFF PLACE 5 GALLON PAIL UNDER NOZZLE, AND TURN ON NOZZLE VALVE FOR EXACTLY 1 MINUTE, CATCHING THE WATER IN THE PAIL MEASURE THE WATER IN THE PAIL TO THE NEAREST 1/4 PINT CALCULATE THE NUMBER OF GALLONS IF THE DELIVERED VOLUME IS TOO HIGH OR TOO LOW, ADJUST REGULATOR, UNTIL DESIRED VOLUME PER MINUTE IS OBTAINED					DO NOT ALLOW KARMEX (TELVAR DW), OR SIMAZIN TO SPILL ON PAVEMENT OR SHOULDER AVOID EXCESSIVE APPLICATION WHICH TENDS TO RUN DOWN SLOPE TO MIX KARMEX (TELVAR DW) ADD 10 LBS TO 4 OR 5 GALS WATER, STIR WITH PADDLE, THEN ADD THE REST OF THE WATER TO THE TOTAL 50 GAL VOLUME WHILE STIRRING VIGOROUSLY WITH A PADDLE - AND WITH THE BY-PASS LINE IN OPERATION ALLOW STIRRING TO CONTINUE UNTIL ALL THE MATERIAL IS IN SUSPENSION CONTINUAL BY-PASS AGITATION IS NECESSARY WHILE SPRAYING			DO NOT SPRAY ROADSIDES ADJACENT TO WATER SUPPLY RESERVOIR OR WITHIN 50 FT OF TRIBUTARY STREAMS		

Figure 36. An example of an herbicide program

thumb was expressed by Dr. R. E. Blaser of Virginia Polytechnic Institute: "Need for fertilization should be based on the condition of the turf" (6).

In the past ten years significant advances have been made in fertilizer use and formulations. High analysis formulations have lowered the relative cost of handling and application. Urea-formaldehyde as a nitrogen source has made it possible to extend the effective period of availability for that element of nutrition. Complete liquid fertilizers have facilitated maintenance fertilization practices on areas (such as wide median strips) adaptable to multiple-nozzle, boom spray equipment.

A fertilizer program should be developed on the basis of a comprehensive study by a qualified professional. Connecticut, for instance, has established such a program (10)

The need for maintenance fertilization is particularly important in two major categories of right-of-way areas.

1. Median areas, and turf sections between the outside berms and primary ditch lines. These are mowed frequently and must be neatly kept for public relations purposes.

2. Slope areas where turf is the principal vegetation and must be maintained for erosion control and aesthetic purposes.

TREES

As mentioned earlier, improved highway design practices include conservation of desirable trees in median and other roadside areas. Obviously, maintenance organizations must use suitable means to insure their continued existence.

A program to effectively realize the potential aesthetic and utilitarian worth of roadside trees includes the following important aspects (7):

1. Dead and dying trees should be removed and disposed of. Losses caused by pests of epidemic proportions, such as the Dutch Elm disease, may require special sanitation measures to prevent unrestricted spread (8). Special precautions should also be taken when removing and disposing of branches of diseased trees.

2. Particularly valuable trees, by reason of their size, species, location or condition, should be given special attention with respect to diseases, pests, injury, and need of fertilization. Trees having outstanding value should be fertilized when it appears that optimum nutrient requirements are not available for vigorous growth. In many instances a high nitrogen fertilizer, such as 10-6-4, applied at a rate of one-quarter pound per inch caliper, will serve as a satisfactory stimulant. On larger trees with widespreading crowns, fertilizer should be applied by placing it in holes punched in a regular pattern in the area beneath the outside 20 percent of the crown.

3. Groups of trees and portions of forests conserved within right-of-way limits should be managed so as to achieve the greatest aesthetic values. If the stands are dense, the less desirable species should be removed to stimulate development of the more valuable kinds. A forest-like growth is more interesting

to the motorist when the edges are open and the interior areas are visible. Flowering trees such as dogwood, redbud, sweet-bay, sourwood, crabapples, hawthorns and others not so well known should be favored by removing competing growth with less virtue. Dead limbs, and in some instances live limbs, should be removed to improve the condition and appearance of otherwise desirable trees.

4. Storm-damaged trees should be cared for promptly. Broken parts should be removed and injured areas treated according to arboristic standards. All wind-blown trees must be disposed of to prevent possible infestation from disease and insect sources.

5. Tree removal and trimming practices by public utility companies should be carefully regulated and supervised in all cases where they occupy the highway right-of-way. Although electric service must be provided and maintained, this does not mean that trees must be sacrificed to provide needed power. In many instances, lines can be relocated to save valuable trees and at the same time make possible more trouble-free service. Another electric utility company activity which can be the source of environmental pollution involves the indiscriminate use of herbicides to eliminate tree growth. Few views along a highway are more unsightly than trees in mid-summer with one-half their crowns killed with herbicides. If the trees interfere with service and must be removed they should be cut during the dormant season. To prevent future growth the stumps can be treated with herbicide and upon the appearance of sprout growth chemical control can be effective.

6. Trees in close proximity to pavements can be hazardous, and maintenance forces at times face the distasteful task of removing poorly located trees for safety reasons. The Michigan Highway Department conducted an extensive study involving car-tree accidents (9). Some highway departments have established criteria for determining whether or not a tree or other hazard should be removed on state trunklines.

ELIMINATION OF NOXIOUS PLANTS

Wider rights-of-way and the construction of more and more highway rest and relaxation areas are invitations for the highway user to enjoy multiple benefits. But the really pleasurable use of such amenities requires an environment that is free of injurious vegetation. This means that it is necessary to get rid of plants such as poison-ivy, poison-oak, poison-sumac, stinging nettle and other species that cause serious skin irritations. Allergy producing plants such as ragweed should also be eliminated when concentrations occur in, and adjacent to, areas of concentrated use. Particular care should be taken to remove harmful species from roadside rest areas, picnic-table sites, overlooks, historic sites, and other obvious stopping points along the roadside.

And from an economic standpoint, a great deal of lost time suffered by highway maintenance employees can be prevented through judicious use of herbicides.

Many states have laws requiring eradication of noxious weeds, including Canada thistle, poison hemlock, quack grass, dodder, budweed, horse-nettle and

others. When these plants occur on roadside areas adjacent to farm lands they should be eliminated with the same sanitation measures used to eradicate those species associated with human discomfort. Standard formulations of 2, 4-D and 2, 4, 5-T, when used as prescribed by the manufacturer, will provide effective control of most noxious plants at reasonable cost. Some states have developed herbicide manuals (10, 11).

LITTER

The control of litter has become a burgeoning and expensive operation for every highway administrator. It eats up funds that could be used to build needed new highways or to improve existing ones. Estimates indicate that states and counties spend about \$100 million a year just on the "litterbug" problem along state and county roads and highways. The most discouraging aspect of litter is that it represents an entirely needless act that negates efforts to develop and enhance roadside aesthetics.

Any program that will effectively deal with the roadside litter problem calls for each state to establish an administrative unit responsible for all facets of the operation, including an intense information program geared to the public, the press and cooperating agencies. Litter control and prevention is basically a



Figure 37. The litter shown here is not only unsightly, it is also very expensive to gather.

matter of education. Ideally, of course, such education should start in early childhood and should originate in the home, schools, churches, and community organizations (12, 13).

The public information aspects of a litter control program should be augmented by attractive receptacles, adequate in number, conveniently placed, and scrupulously maintained. Machines to gather efficiently litter along the roadside have not yet been designed. Manual collections are required under the majority of highway conditions, usually by maintenance crews that are taken away from other duties.

Litter law violations should be treated as misdemeanors and as such be subject to rigid enforcement, vigorous prosecution, prompt adjudication, and severe penalties.

SUMMARY

The maintenance of roadside areas must be an important consideration during the design phases. Design and maintenance determine the aesthetic values of the highway environment. Everyone benefits when appropriate designs are brought into reality (2).

Maintenance work should be done during the most effective season for each class of operation. Mowing intervals should be governed by growth rate to avoid rakings; fertilizing should precede maximum growth periods; thinning and pruning should precede the dormant period.

Maintenance of roadside vegetation should be predicated on the need to establish and encourage an environment similar to that existing on adjacent public or private lands. In urban residential areas, for instance, it is essential to have shade trees and turf. Groves of trees should be conserved or established in large interchange islands in order to reduce the mowing area. This is an expression of good design correlated with economical maintenance and productive of aesthetic values. Effective roadside maintenance is actually the end result of a collaborative effort that makes a highway safer to travel and more attractive visually.

REFERENCES

- 1 Butler, B J, and Yoerger, R R Current Trends in Equipment for Roadside Cover Establishment and Maintenance HRB Roadside Development 1962, pp 59-91
- 2 Hottenstein Common Sense Turf Management on Today's Highways HRB Roadside Development 1963
- 3 O'Brien, Robert W Effect of Contract Mowing on Massachusetts Maintenance Costs Highway Research Record No 11, pp 23-49, 1963.
- 4 Robins, Craft, and Raynor Weed Control McGraw-Hill
- 5 Maleic Hydrazide as a Growth Retardant Materials and Research Section, Minnesota Dept of Highways, 1965
- 6 Blaser, R E, Thomas, G W, Brooks, C R, Shoop, G J, and Martin, J B, Jr Turf Establishment and Maintenance Along Highway Cuts HRB Roadside Development 1961, pp 5-19
- 7 Planning and Management of Roadside Vegetation An Analysis of Principles Highway Research Board Spec Rept 23, 1956
- 8 Connecticut State Highway Dept Tree and Shrub Fertilizer Program Spring, 1965—also—1965 Seeding and Turf Fertilization Program
- 9 Car-Tree Deaths Bring Action Michigan Roads and Construction, p 6, Nov 11, 1965
- 10 Herbicide Manual, March 1961 Landscape Bureau, New York Dept of Public Works, Div of Operation and Maintenance

- 11 Roadside Weed and Brush Control with Chemicals Purdue Univ Eng Exper. Sta , County Highway Series No 2
- 12 Nimbo Model Anti-Litter Ordinance, Annotated National Institute of Municipal Law Officers, 1957
13. Antri-Litter Statute (Arizona Revised Statutes) No 18-162, July 1956

FUTURE OF ROADSIDE DEVELOPMENT

ONE measure of the state of maturity of a civilization is its concern for the environment in which it exists. The future of roadside development in America is very much linked to the rate of this maturation.

The highway right-of-way was once considered an entity in itself, both functionally and visually, and roadside development meant concern only for the land within this strip not occupied by pavement.

In our Nation's growing understanding of the need for total environmental planning and design, the highway is not now seen as a right-of-way with a relatively narrow band of pavement and some immediately associated appurtenances, but as one element in an environmental complex—a visual corridor within which roadside development has a major function to provide a transition between the pavement and the adjacent landscape or cityscape, a foreground to the controlled progressive display of natural scenes and man-made developments. In short, we are now more than ever concerned with the "Complete Highway."

Roadside development must start with highway planning and location; with appropriate design that will consider and use elements of the environment; with acquisition of adequate rights-of-way to implement such design; with controls sufficient to prevent or eliminate objectionable visual elements beyond the right-of-way through screening, easements, zoning, and education; with conservation of existing environments that need not be altered or destroyed.

Thus, true roadside development is neither a remedial exercise in solving functional problems created by necessary construction, nor an attempt to rectify mistakes of improper location or poor geometric design. It is rather a continuation of the design process begun with the first reconnaissance studies, and its goal is the integration of the highway with the landscape in a manner that will best serve the interests of those who use it and those who live near it.

The future, hopefully, will bring even further emphasis on highway development aimed equally toward functional excellence and visual satisfaction. It is quite safe to predict that continued research, experimentation, and product development will provide increasingly better solutions for the control of erosion, snow, noise, headlight glare and plant growth.

It is equally safe to predict future acquisition of adequate rights-of-way allowing generously for both grading and roadside development. There will also be refinements and controls of site preparation and construction operations that will leave undisturbed most of the stabilized land forms and vegetation within the right-of-way not to be occupied by cuts and embankments.

A future can also be hopefully anticipated in which litter, outdoor advertising, junkyards and other objectionable roadside distractions will have disappeared from the visible landscape along the highways

The continued increase of safety rest areas and scenic turnouts seems assured and the growth of driver and passenger services in these areas will continue to satisfy public needs and wishes

The future of roadside development, however, lies most in the willingness of those responsible for highway development to recognize that the visual experiences of the traveler are important to his welfare.

In this they must be supported vocally and financially by the public they serve. The skills of those trained in the creative design of land must be used in all stages of the highway development process, from reconnaissance to ribbon cutting.

It is only through early and continued collaboration of planners, engineers and landscape architects that the "Complete Highway" can become an integrated, compatible element in the environmental composition of our landscapes, contributing immeasurably to a better **America** for every citizen.

LEGAL AUTHORITY AND TECHNIQUES FOR ROADSIDE DEVELOPMENT

The following comments were prepared by Dr. Ross D. Netherton, Counsel for Legal Research, Highway Research Board, from material recently compiled and published under the sponsorship of the Board's Department of Legal Studies. They are included here as a necessary supplement to the information given in the preceding chapters.

ADVANCEMENTS in the concepts and techniques of highway design and landscape engineering—and in particular the concept of the “scenic highway corridor” or “Complete Highway”—have impelled highway administrators to review the authority and procedures which their state's law provide for roadside development. In some instances, questions have arisen about whether existing legal authority of highway agencies is adequate to permit full and efficient implementation of the concepts that have captured the imagination of highway policy-makers and landscape architects.

Preliminary examination of the legal framework within which most states operate indicates that needed modification of state laws may range from relatively minor administrative actions to amendments of the state constitution. A clear understanding of the “pressure points” in the legal framework of the highway program is therefore necessary for an evaluation of the effectiveness of the present law to stand up under pressure.

Viewed in the broadest perspective, the highway departments' legal authority to implement roadside development programs resides in the following four general powers: (1) the power to regulate directly the use of public highways and the privately-owned land adjacent to them—commonly called the “police power”; (2) the power of eminent domain, allowing public agencies to take private land for public purposes through formal procedures assuring compensation for the land taken; (3) the power to make contracts, allowing highway agencies to acquire and exercise a wide range of rights of a special character with respect to property; and (4) the planning function, by which guidelines influencing both public and private programs are formulated.

THE POLICE POWER

Since the U.S. Supreme Court's decision in *Berman v. Parker*,¹ there has been no doubt that the police power could lawfully be directed toward the accomplishment of positive aesthetic results—that it was not a purely protective power, defend-

¹ 348 U.S. 26 (1954)

ing the community against active dangers, but that it was capable of being used creatively to shape the community's physical environment as well as its economic and social well-being. In most states, the application of regulatory measures to the land adjacent to the highway appears to be the easiest and most economical means of achieving roadside development goals. Examination shows, however, that in several important respects the states' laws regarding the police power need clarification.

Various views exist regarding the extent to which amenity and aesthetic considerations may serve as bases for police regulation of roadside land uses. It seems generally agreed that the presence of these factors along with others representing health, safety, morals or economic well-being *does not disqualify* the latter as bases of legislative or administrative action. It is evident, however, that most courts still prefer to rely primarily on these latter bases, and only incidentally on aesthetic considerations.² Recent decisions in New York, Kentucky and Oregon, all upholding regulation of roadside land solely to achieve aesthetic goals, may, however, signify a growing willingness to extend the roadside landowner's responsibility for harmonizing his own development plans with those of the highway designer and landscape architect.³

Historically, zoning has been the chief means of implementing roadside development plans. Current critics of zoning believe, however, that if this technique is to remain the most favored, ways must be found to introduce more flexibility into its administration and to bring the entire regulatory process closer to the planning process. These suggested needs would seem to be sharpened when applied to protection of features and facilities in scenic corridors. Proposals for regulation of roadside land use will have to consider not only the differing needs of various features for protection and preservation, but also a suitable allocation of administrative responsibility among state (and perhaps local) agencies responsible for highways, conservation, recreation, resource development, historic preservation, and fish and game preserves. In approaching these problems, significant aid is likely to come from the experience of Wisconsin and California in their scenic highway program, and the long-standing Federal-state cooperation in the development of roads in national forests.

EMINENT DOMAIN

As with the police power, the past two decades have seen significant expansion of the function and scope of eminent domain. In terms of function, it is now accepted that eminent domain may be used not only to acquire property for the actual sites of public works but also for protective purposes surrounding such sites. This growth has accompanied a subtle shift in the concept of the "public purpose"

² Highway Research Board, *Outdoor Advertising Along Highways*, (Washington, 1958), Rodda, C., "Accomplishments of Aesthetic Purposes Under the Police Power," 27 So. Calif. Law Rev. 149 (1954).

³ *People v. Stover*, 191 N.E.2d 272 (N.Y., 1963), *Jasper v. Commonwealth*, 375 S.W.2d 709 (Ky., 1964), *Oregon City v. Hartke*, 400 P.2d 255 (Ore., 1965).

which is to be served by the condemnation.⁴ In recent decisions discussing this question the concept of "public purpose" has become equated to "public benefit," so that courts will usually uphold any use of eminent domain in which it is demonstrated that a benefit to the public will result. Legislative determinations of public benefit almost always are accepted as conclusive by the courts.

This broadened concept of public purpose has significance for roadside development for two reasons. In one direction it has opened the way to acquire property interests outside the highway right-of-way to permit more extensive and varied development and scenic enhancement of roadside areas. Thus, current proposals to increase the establishment of roadside rest areas, scenic overlook points, informational facilities, and scenic views from the highway contemplate public acquisition, development, and operation of selected sites alongside the right-of-way. Such taking of land in excess of construction needs has been justified either (a) for elimination of uneconomic remnants which otherwise would be left in private ownership, or (b) to avoid payment of excessive severance damages in regular condemnation cases. Acquisition under either theory may be followed by public ownership and development, or by resale or lease to private parties for development and use in accordance with conditions specified by the state.

Authority for condemnation of land in excess of construction and maintenance needs is specifically provided in the constitutions of nine states, and is considered to be implicitly within the scope of most other state highway departments' statutory authority to condemn. To date, however, no state has made extensive use of this authority, or explored its possible uses in an expanded program of roadside development.

The second major result of expanding the concept of public purpose involves a major innovation in the function of eminent domain by promoting its use for the acquisition of "negative rights" designed to serve as passive, protective devices. Such use of eminent domain is illustrated by the acquisition of scenic easements and roadside advertising rights having the effect of preventing private use of roadside land in a manner which destroys the amenity or natural scenic quality of the protected area.⁵ Notable examples of the successful development of scenic highways by this means are the Minnesota and Wisconsin segments of the Great River Road. In the field of roadside advertising control Nebraska and North Dakota have recorded several court decisions supporting the state's authority to condemn advertising rights and clarifying the rules of valuation which apply.⁶

Despite these indications that state highway departments' eminent domain

⁴ Netherton, R and Markham, M, *Roadside Development and Beautification Legal Authority and Methods, Part 1*, (Highway Research Board, Washington, 1965), discusses state and federal laws relating to use of eminent domain and purchase techniques for roadside beautification.

⁵ Particularly valuable discussions of the use of scenic easements may be found in Johrdahl, H., "Conservation and Scenic Easements An Experience Resume," 39 *Land Economics* 343 (1963) and the Proceedings of the Conservation Easements and Open Space Conference, sponsored by the Wisconsin Department of Resource Development and State Recreation Committee, December 13-14, 1961, Madison, Wisconsin.

⁶ *Fulmer v State Department of Roads*, 134 N W 2d 198 (Nebr., 1965).

authority is ample enough to allow acquisition of property rights outside of the right-of-way, relatively little use of the eminent domain authority for these purposes had occurred prior to the recent Presidential call for increased efforts to preserve and develop the nation's natural beauty in February 1965. Subsequently, Federal-aid legislation and state enabling legislation, aimed at implementing this advancement in the national highway policy, have laid the foundation for a greatly expanded program of property acquisition in the roadside areas adjacent to Interstate and Federal-aid primary highways and specially designated scenic roads and parkways.

A possible further legal problem connected with the acquisition of property for roadside development has been raised by the existence in 28 states of constitutional amendments requiring that state highway user-tax revenue be used only for highway purposes. While these so-called "anti-diversion amendments" have a common intent and background, there is considerable variation in their language, some stating that highway user-tax revenue must be "used solely for construction, reconstruction, repair and maintenance of public highways." A recent decision of the North Dakota supreme court has held, however, that the state highway department's use of its earmarked tax funds for acquisition of outdoor advertising rights outside the right-of-way of the state's Interstate System highways was not an unlawful diversion of highway funds.⁷ Further clarification of the application of the anti-diversion policy of the state and Federal highway law will no doubt occur as programs for development of scenic highway corridors reach their full scope. Evidence of the liberal attitude of the courts in the interpretation of the restrictive language of these laws—revealed in their rulings on use of highway user-tax funds to acquire access rights, marginal lands, advertising rights, and pay the costs of relocating utility fixtures and displaced persons—strongly suggests that the prevailing concept of highway purpose is broad enough to include roadside development.

THE POWER TO CONTRACT

Used to its full capability, the power of public agencies to enter into and perform contractual arrangements may be used for the purchase of property, the procurement of services, and sharing of costs and responsibilities for roadside development, and many other objectives. Using this authority public agencies may arrange cooperative programs, or may give assistance to and receive assistance from private groups.

The versatility of such arrangements is shown by the example of the Maryland State Roads Commission in entering into cooperative roadside landscaping agreements with municipal governments and citizens' garden clubs. Under these agreements the costs of materials and the labor necessary for roadside plantings are shared among all parties to the arrangement. This practice has resulted in improving the general appearance of numerous segments of urban and small town

⁷ *Newman v State*, 133 N.W.2d 549 (N. Dak., 1965)

streets and roads, and, if widely adopted, could complement the special efforts made to landscape the roadsides of major express highways and urban area parkways

The versatility of the contractual power may also be seen in the establishment of protective patterns of land use in roadside areas. As used in Wisconsin's current 10-year program of resources development, contractual arrangements have been used variously to develop the recreational use potential of land, protect natural scenic beauty and amenity, preserve open spaces, and to guide the pace and location of urban development. The Wisconsin experience illustrates how, once public objectives are clearly defined in legislation and administrative directives, the contracts, covenants and easements may be adapted to the particular needs and wants of the landowner, the public, and the terrain of the site involved. Negative aspects, limiting what the owner may do with his land, may be balanced with positive aspects, in which public-private cooperation may be undertaken to promote private development along lines which enhance community benefits.⁸

Roadside improvement and development objectives have also been advanced by means of agreements between public agencies and private landowners in which incentives have been offered for establishment and maintenance of scenic views. While little experience exists with the incentive approach, experiments are being conducted under state legislation enabling counties to grant property tax advantages to owners who agree to protect scenic views, and federal laws making possible the extension of Soil Bank benefits to landowners who agree to manage land in accordance with specified development standards

The public power to contract (or make bargains) has also been used in the administration of planning and land use control laws. Thus, permits to develop or redevelop land have sometimes been issued on condition that the developer set aside a certain amount of land for open space, or recreational facilities, or future streets or street widening. Landowners may also be required to impose restrictive covenants upon the land they develop, so that these covenants "run with the land" to subsequent owners who must preserve the standards laid on by the developer. Such standards have been effectively used to preserve the appearance and character of residential, historic, and parkland areas, and have been suggested as equally useful to maintain roadside areas having features or facilities of particular interest.

Valuable experience in using agreements to establish cooperative working relationships in the planning and management of transportation systems in urban areas is currently being acquired as a result of the Federal-Aid Highway Act of 1962.⁹ This experience offers both the opportunity to incorporate roadside development principles into the planning of urban highway systems, and the opportunity to apply the same cooperative techniques to the development of regional programs for developing facilities combining scenic, recreational, historical, and conservation features.

⁸ Proceedings of Conservation Easement and Open Space Conference, note 5 *supra*

⁹ Title 23, U. S. Code, *Highways*, Sec 134

The extensive power of public agencies to enter into contracts and perform agreements offers a variety of possible applications to the work of roadside development. Having the advantage of extreme flexibility, it is adaptable to a wide range of public objectives and private desires.

THE PLANNING PROCESS

Although seldom characterized as one of the "powers" of government, the planning functions carried on by public agencies are nevertheless capable of exerting important influences on the actions of private landowners and developers. The plans of public agencies for locating various service facilities (such as highways, sewers, and water systems) within a region inevitably hasten or retard the pace of private land development. What a public facility looks like also often influences the appearance of the private development that grows up around it. Public planning, therefore, has the capability of reducing the environment of a community to the lowest common denominator of public taste, or of expressing standards which compel developers to design and build up to the best ability of all concerned.

To what extent is the planning process in highway programs now recognizing the potential of the roadside, and providing for its development?

American highways generally, and even the vast highway modernization program begun in 1956, have not enjoyed a reputation for fostering a balance between functionalism and beauty. In the showdown functionalism has prevailed. Insight concerning this tendency has been provided by the statement of the Federal Highway Administrator in September 1965, as follows:

We in the highway profession recognize and accept certain basic responsibilities, whether in finding a specific new route location, designing a project, or planning an entire new highway program. But we have other responsibilities in our planning to cause the least possible disruption or damage—and even to enhance where possible—the locations and situations upon which our highways impinge. These include forests and wildlife habitats, parks, recreation facilities, close-knit community areas, historic and scenic sites, and the landscape generally.

Such objectives are not always altogether attainable, but highway planners are sincerely trying to achieve them. If we cannot meet all demands by all interests, it is not because we are not interested. Sometimes the non-traffic demands conflict among themselves, or with traffic safety. Sometimes they are wholly unreasonable, or far too costly, or cannot legally be paid for from highway funds.

If highway officials have seemed hesitant to spend money for social needs and amenities affected by highway construction and use, it is because by tradition their responsibility has been to the highway user who pays the bills. But in this age of the Great—and complex—Society, the highway user must accept expenditure of reasonable amounts of his taxes for such purposes. I believe that he does willingly accept this, as a proper part of transportation cost and as a social responsibility. So the highway official need be less hesitant than he used to be.¹⁰

Following the President's Message on Natural Beauty in February 1965, responsible spokesmen for the departments of the Federal government whose

¹⁰ Press Release, US Department of Commerce, containing remarks of Federal Highway Administrator at the annual meeting of the American Forestry Association, September 6, 1965.

principal activities involve conservation, roadbuilding, public lands, and natural resources all commenced programs to systematically preserve or promote natural scenic beauty as part of their work. Joint efforts of these agencies to actively improve the scenic quality of the corridors through which the highway system runs were commenced through a study of the possibilities of creating a Scenic Roads and Parkways Program within the Federal-aid highway program

Elsewhere within the Federal-aid legislation already in existence attention was called to provisions of the law—some of which had remained relatively unknown and unused for the past twenty years—which offered possibilities to planners and highway engineers. New resources were added through the Highway Beautification Act of 1965, enacted by Congress in October 1965, which provided authority for immediate appropriation of non-matching Federal funds for states to acquire additional land adjacent to Federal-aid Interstate and primary highways for expanded roadside development.

This fresh emphasis on the goals and benefits of preserving and enhancing the amenity of highway design and roadside development, coupled with tangible legislative and financial support, have given the planning profession both the motivation and the means to assert the leadership influence of which planning is capable.

REFERENCES

- 1 Netherton, R and Markham, M. *Roadside Development and Beautification: Legal Authority and Methods*, (Hwy Res Bd Washington, D C, 1965). Part 1 deals with authority to acquire property through eminent domain and purchase techniques, Part 2 deals with regulation of land use under the police power.
- 2 Rodda, C, "Accomplishment of Aesthetic Purposes Under the Police Power," 27 *So Calif Law Rev* 149 (1954).
- 3 Dukemener, J J, "Zoning for Aesthetic Objectives: A Reappraisal," 20 *Law & Contemporary Problems* 218 (1955).
- 4 *Proceedings of Conference on Conservation Easements and Open Space*, sponsored by Wisconsin Department of Resource Development and State Recreation Committee, December 13-14, 1961.
- 5 Johrdahl, H, "Conservation and Scenic Easements, An Experience Resume," 39 *Land Economics* 343 (1963).
- 6 U S Senate, *Hearings before the Subcommittee on Roads of the Committee on Public Works*, 89th Cong, 1st Session, August 10-13, 1965, "Highway Beautification and Scenic Road Program."
- 7 U S House of Representatives, *Hearings before the Subcommittee on Roads of the Committee on Public Works*, July 20-22 and September 2, 7, 1965, 89th Cong, 1st Sess, "Highway Beautification."

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