# HIGHWAY RESEARCH BOARD
# REPORT OF THE COMMITTEE ON ROADSIDE DEVELOPMENT

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A chain is no stronger than its weakest link.

The complete highway chain comprises the travelled way, the shoulders, the drainageways, the roadsides, the waysides and bordering services.

During the past eighteen years the Committee on Roadside Development has molded many links in this chain including erosion control, turf culture, streamlined cross section, border-control measures, trees, shrubs, ground cover plantings, etc. As we progress the weak links will be tempered or strengthened. During this process the release of progress reports will furnish the latest data available, and we hope enlist cooperation so that the end result will be of real service to all.

This year's meeting of the committee was devoted to the very important shoulder link in the complete highway chain. This was molded and partially tempered as evidenced by the report of the project committee on shoulders which will be published in our report.

In succeeding years the committee proposes to mold and temper, in order, links of (a) roadside drainage facilities, (b) roadside designs for erosion control, trees, shrubs, and vine plantings, (c) wayside park design, (d) bordering service entrances, etc. The complete molding of the many links and tempering them for strength and serviceable use will provide us with a long contemplated and strongly needed manual on roadside development.

Brief synopses of the reports and papers presented at this year's meeting follow:

## Division 1 - Design, Right-of-Way and Border Control

1. Climatic Factors Controlling Roadside Design and Development, by Charles R. Hursh, in charge of Division of Watershed Protection and Management, Southeastern Forest Experiment Station, U. S. Forest Service.

Studies have been directed principally toward finding out the effect of tree plantings for sheltering cropland against drying winds and for protecting habitations against the heat of summer and the rigors of winter. Measurements have also been made of the effects of complete denudation of the natural vegetation cover in comparison with adjacent areas in forest and grass. Research findings in these studies have many applications to roadside development problems.

Land areas under tree or grass protection do not show the extreme variations in soil temperatures characteristic of bare soil. Dense brush and low trees retard snowdrift formation. Wind velocities over bare soil may be fifteen times as great as over adjacent forested areas and eight times as great as over grass land. Such velocities dry out surface soils rapidly. Daily range of surface soil temperatures may be 33.5 F. as compared with a daily variation of only 10.9 F. under heavy vegetation.

Mulches and planting during proper seasons are necessary in establishing vegetation on bare soils such as those on highway slopes.

In addition to protection against wind, mulches or vegetative cover are needed to prevent rapid freezing and thawing of soils on cut and fill slope. Slopes facing to the south or west particularly need insulating protection against the sun. Smooth surfaces on cuts and fills are particularly conducive to harmful frost action causing slumping and sliding of slope soils. Such soil movement makes establishment of vegetation very difficult. All these observations point to the need of establishing protective vegetation on road slopes as soon as possible after grading.

All factors facilitating ready establishment of protective vegetation on road slopes should be considered during original highway location and design. Harmful effects of surface soil movement, extreme daily variations in temperature, rapid loss of moisture, direction of slope exposure, and high wind velocities can be greatly reduced by forethought.

An understanding of the aims and requirements of plant establishment is the first step. A better knowledge of how the climatic factors controlling roadside design and development are modified by engineering works and how they affect plant growth will expedite obtaining the best final results in terms of efficiency and economy.

2. Transitional Grading of Highway Slopes, by Robert S. DuBois, Principal Highway Design Engineer, Public Roads Administration.

This deals with reasons why the use of transitions in forming roadsides is desirable.

Sound economic principles, applied to roadsides, result in the use of transitions molding the roadsides to flow from form to form. The use of transitions provides increased stability, economies in maintenance and greater safety. Improved appearance is provided concurrently. The work offers a natural, pleasing appearance.

"Prism" construction is unsightly in character. It is usually difficult to secure a good stand of vegetation which will protect the slopes against erosion and conceal the scars caused by construction.

The sweep of the terrain is not composed of planes, straight lines or simple curves. The surface flows from form to form. Highway roundings and other transitions should be of similar character, using curves like parabolas rather than circular curves and straight lines, in order to be more pleasing.

Variations secured by transition treatments include the use of flatter slopes where cuts and fills are lower, the rounding off of the intersections of slopes with the natural ground surface and at the shoulders where feasible, and the blending out of the zones between cuts and adjacent fills.

Examples are given of methods of accomplishing such transitions as a part of the highway grading. It has proved practicable to use machine methods to do such work.

3. Slope Design Practice in the Great Smoky Mountains National Park, by F. W. Cron, Senior Highway Engineer, Public Roads Administration.

Roads in the National Parks should be inconspicuous and cause a minimum of damage to the landscape. Designs and specifications which provide for intensive public use of the roadside, control of erosion, and blending of construction with the natural contours have been developed in the Great Smoky Mountains National Park during 16 years of road building in this mountainous area of heavy rainfall.

Cut and fill slopes are varied to relieve monotony, to provide additional sight distance, to balance earthwork quantities, or to create roadside-use areas. Slopes are rounded and transitioned to fit unobtrusively into the topography. Then they are seeded and mulched for protection against erosion, and to encourage growth of native vegetation. Natural materials such as topsoil, timber and rock are conserved and used. Damage to the landscape is minimized by judicious use of retaining walls and tunnels and by protecting standing timber from damage during construction operations.

Numerous public-use areas are created by removing ridges and small hillocks from the outer sides of large cuts, or by filling in pockets between embankments and the mountainsides. Some of these are formally developed as parking areas and overlooks.

Experience has shown that these measures not only contribute to the public's enjoyment of the highway but also result in substantial savings in maintenance cost, and conserve the natural and recreational values for which the park was established.

4. Median Planting for Control of Headlight Glare in New Jersey, by Robert S. Green, New Jersey State Highway Department.

Planting of median strips of divided highways was first done in New Jersey to improve general highway appearance. Experiments in recent years have demonstrated the possibility of screening opposing traffic from headlight glare by planting that does not obscure visibility at intersections or cause the formation of snowdrifts on the travelled way.

Three types of shrub planting were tried, ranging from a continuous hedge on the median center line to a series of short hedges or "angle plantings" placed at intervals of 50 to 60 feet, at an angle of 15 to 18 degrees from median curb to curb.

Angle plantings appear to be continuous at night, economize in materials, do not dangerously obscure vision at crossovers, and largely avoid the formation of snowdrifts. These advantages are not shared by continuous hedges or informal group plantings formerly used.

4.

5. Report of Subcommittee on Right-of-Way and Border Control, Nelson M. Wells, Chairman, Director of Landscape Bureau, New York Department of Public Works.

This report outlines the scope and objectives of the committee.

The objectives of the committee include a consideration of the extent of right-of-way to be acquired for roadside development; the relationship of various highway elements to adjacent bordering property; the desirable regulation of the right-of-way area for its use by others; and the desirable kinds and limitations of public control on lands bordering the right-of-way, all for the purpose of promoting safety, efficiency and beauty on the roadsides for the designed use of the highway by vehicles and pedestrians.

By correlating the findings of other project committees and the Committee on Land Acquisition and Control of Highway Access and Adjacent Areas together with an independent assembly, analysis and promotion of some of the numerous factors relating to roadside development, the interests of this project committee will be progressed.

DISCUSSION

NELSON M. WELLS: The topics enumerated as committee interests are very diversified. We would appreciate suggestions as to which topics the committee might concentrate upon in order to be of the greatest immediate value.

Topics Emphasized for Project Committee Consideration Were:

Land drainage; the relationship of utility lines to the highway cross section design from the standpoint of legislation, zoning and the protection of roadside trees; policies in the respective states regarding utility lines and trees; and controlled access and the control of architecture on bordering property.

Division II - Construction and Maintenance

1. Report of Project Committee on Shoulders, Harry H. Iurka, Chairman, Landscape Architect, New York State Department of Public Works.

This committee offers its conception of the purpose of road shoulders and reviews briefly the literature on the effect of shoulders on traffic performance.

The committee reports definite contributions made toward solution of one of the problems outlined in 1946 on the basis of which suggestions for the construction of stabile turf shoulders are made. Laboratory and field analyses of test projects are recommended to the end that reports on these may be integrated. Other problems to be studied by the committee are defined.

2. Shoulder Construction Practice in Michigan, by E. A. Finney, Research Laboratory, Testing and Research Division, Michigan State Highway Department.

Michigan uses two general types of shoulders: one of turf-covered earth and gravel eight feet wide, and a second with a two-foot strip of oiled aggregate with the outer eight feet of turf-covered earth.

The first type of shoulder is provided with a fifteen-inch granular subgrade, where plastic soils occur. The upper six inches of earth surface soil is in all cases stabilized by addition of binder soil to bank-run gravel or other granular soil materials. This mechanically stabilized shoulder soil is seeded. The second type of shoulder is similar to the first except for the two-foot strip of oiled aggregate adjacent to the traffic surface. Seeding of turf-covered shoulder areas in both types of shoulders is done during the first spring seeding season (April or May) following construction. The shoulder is harrowed to a depth of about 3/4 inches, or deeper, fertilizer is harrowed in and mulch is worked into the loosened shoulder surface. About 50 pounds of mixed seed is then applied and rolled or covered by use of a chain drag.

Turf shoulders in Michigan usually tend to subside below the load of traffic surfaces and are maintained by adding a mixture of soil and gravel.

All soil mixtures used for shoulder construction are equivalent to an $A_3$ soil. Salvaged loams are used mixed with necessary gravels and clay soil binder materials.

In cases where shoulder surfaces rise above traffic surfaces turf is bladed off by one-inch stages to avoid damage to grass roots.

3. Progress Report on Experimental Stabilized Turf Shoulders for New Jersey Parkways, by Oliver A. Deakin, Parkway Engineer, New Jersey State Highway Department.

Experimental mechanically stabilized turf shoulders were constructed during 1947 by the New Jersey State Highway Department. Fourteen hundred feet of test shoulders were divided into seven 200-foot plots on each side of State Highway Route 30. All shoulder plots were ten feet wide with a pitch of five percent. Various mixtures of sand, soil, and crushed rock aggregates were used. Turf was established by seeding.

It was found that by raising snowplow blades snow removal could be performed without damage to the turf.

During the spring thaw ruts only about $1\frac{1}{2}$ inches deep result from trucks run over these stabilized turf-covered shoulders. Slight heaving of shoulders was corrected by rolling with a five-ton roller without damage to the turf in spring.

Top-dressing is done in spring with loam topsoil and 5-10-5 fertilizer. Reseeding with a bluegrass redtop, bentgrass and ryegrass mixture follows.

Costs of rolling and repairing shoulders are being kept, together with mowing records. Shoulders were carefully studied to find causes of "build-up". Depth of root penetration in various combinations of soil, sand and crushed rock aggregates are being made. It is believed that these stabilized earth road shoulders with turf cover combined with a three-foot bituminous paved strip next to the traffic lanes will be the eventual answer to the problem of providing better shoulders on New Jersey highways.

4. Turf on Stabilized Soils, by Edward B. Cale, Office, Chief of Engineers, Department of the Army.

Supplementing its early work in the southeastern portion of the United States, the Corps of Engineers in 1946 established a joint drainage and turf runway test section at Nahant, Massachusetts.

Four of the six major test items are discussed. Three of these are bankrun sand gravel, 18 inches in depth, and one is ½ inch crushed rock, 18 inches in depth. One item of sand gravel and the item of crushed rock are on an impervious bituminous subbase. The other two items are on a compacted silty clay subgrade. Each item was topped with about six inches of sand gravel into which a small quantity of silty loam was incorporated.

The test areas were limed, fertilized, and seeded to red fescue. Irrigation was used only to establish the fescue. Plots were maintained through two summers without further irrigation.

Turf was easily maintained on all sand-gravel items. It suffered severely from drought on the crushed-rock item during the first summer. In April 1948 roots were found to have penetrated to a depth of 15 inches into all items. Density of the cover varied with the amount of nitrogen which had been applied. It was evident that higher than normal rates of fertilizer are required on such stabilized bases. With this exception, turf can be maintained on stabilized bases by normal management practices.

Although this deals with airport runways, it is closely allied with the highway shoulder problem.

5. Report of Project Committee on Turf Culture, by John Monteith, Jr., Consultant, Washington, D. C.

Seeded or sodded grasses on roadside slope areas are often replaced by herbaceous or woody ground covers or tree growth without disadvantage in the control of erosion. On other areas such as road shoulders it is important to obtain a turf with certain desired characteristics.

One type of seeding specification frequently observed calls for one or two kinds of grasses carefully selected for known reasons to meet known soil and climatic conditions. A second type of specification too often calls for a haphazard "shotgun" mixture including most of the kinds of grasses or legumes known to the specification writer. Because desirable seeds are now a large item in total costs of turf establishment "shotgun" methods of specification writing are to be avoided.

A second basis for seed selection lies in careful examination of roadside areas seeded with known grass-seed mixtures in previous years. Often a kind of grass that formed a very small percentage of original grass-seed poundage will be found to have formed ninety percent or more of the existing turf. In this case, grasses forming a large percentage of the original seed mixture were not wisely chosen.

In some regions certain fescues, bluegrasses or Bermuda grass will come in no matter what kinds of grasses were originally seeded, sprigged, or sodded. Elsewhere the proper choice of a grass species to be established can only be decided by field observation of areas seeded with known seed mixtures in former years.

Accurate field observation, rather than complicated research experiments, is likely to give the best answers to problems of seed specification writing.

6. Can Wood Contribute to Soil Improvement?, by A. C. McIntyre, Soil Conservation Service, Upper Darby, Pennsylvania.

The author, after library research and interviews with farmers in various eastern localities, believes that sawdust, wood chips and shavings, and woody plant stems are very valuable sources of soil organic matter.

Wood contains large percentages of lignin which is broken down into a humus much longer lasting than a humus of organic matter high in cellulose derived from the bacterial destruction of plowed under green manure crops.

Large amounts of sawdust, wood chips and shavings, and plant stems may be admixed with soil to the benefit of crops or ground cover plants provided adequate nitrogenous fertilizers are added in the process of soil improvement.

Mulches derived from wood can be cheaply manufactured by portable "hogs" and grinders now available.

Heavy sawdust or wood shaving mulches have been used in improving soils and increasing the production of orchard crops.

Woody types of mulches are effective in preventing erosion and can be obtained at costs averaging from two to five dollars per ton as compared with much higher costs of other commonly used mulching materials.

7. Report of the Project Committee on Roadside Equipment, W. J. Garmhausen, Chairman, Ohio Department of Highways.

This project committee presented an illustrated description of various types of power operated equipment most recently developed by various manufacturers. Portable hole diggers, mechanical loading equipment, new types of tillage and seeding equipment, and various equipment for mulching, rolling and trash disposal are described.

Division III - Education, Specifications and Public Relations

1. A Model Roadside Short Course, by Professor P. H. Elwood, Ames, Iowa. Head, Division III - Committee on Roadside Development.

Subjects covered at such short courses as conducted at Iowa State College and the Ohio State University are reviewed. A two- or three-day period is the

usual length of program, depending upon the availability of experienced and able speakers. Programs for short courses should emphasize the close relationship between engineering and landscape design in all phases of highway development.

A list of subjects worthy of inclusion in short course programs is given and the need for promotion of such schools in universities of various regions of the country is emphasized.

2. Project Committee on Education, by D. D. Dupre, Jr., Chairman. Landscape Architect, The Ohio State Highway Department.

This committee presented a preliminary outline for obtaining 35mm kodachromes showing roadside operations in various states, and suitable for distribution as a traveling library for use by the several state highway departments in their educational programs.

3. Report of Project Committee on Publications, by George B. Gordon, Chairman. Public Roads Administration.

The committee has taken time to review the published proceedings of road schools and regional highway conferences held at universities and colleges during the past twenty years. Selected papers dealing with highway design, construction and maintenance as related to roadside development are abstracted. A tabular classification of road schools and highway conferences is made and an annotated bibliography of references is presented. All papers presented at a typical road school over a period of two decades are classified as to subject matter.

It is of particular interest to note that of some 443 papers presented at this school over the years, a total of four deal with roadside development and less than two percent cover the design and development of highway areas between the traveled way and the property lines. This is pertinent in view of the fact that (1) about one-half to two-thirds of the area of most primary highways lies within the roadside zone, and (2) a large proportion of highway department funds are expended on maintenance, snow removal, and other operations affecting the roadside portion of our highways.

4. Project Committee on Specifications, by Harold E. Olson, Chairman. Minnesota State Highway Department.

A progress report was presented and will be distributed through the "Clearing House".

5. "Clearing House", by Frank H. Brant, Landscape Engineer, North Carolina State Highway and Public Works Commission.

Timely distribution of roadside information was continued through this medium during 1948. The committee recommends that this important information service be continued.