

REPORT ON HIGHWAY GRADING AND DRAINAGE

Wilbur H. Simonson, Head
Division I, Committee on Roadside Development

UNIT II of the 5-year program of the Committee on Roadside Development related to highway grading and drainage. A progress report on this unit of committee activity was published in 1950. The principles basic to the classification of types of highway-drainage problems were outlined. Six major climatic regions of the United States were classified and described in the 1950 progress report.

Last year, current progress in roadside drainage design was reviewed. Beginning on page 75 of the report for 1951, some of the changes in the concept of highway drainage were noted. The highway engineer is concerned not only with drainage on the right-of-way itself but also with the problem of control of water running down from lands above the highway, as well as his own responsibility in the controlled disposal of water on lands below the highway. Under this more complete concept of drainage for conservation of water resources, in the entire area of the highway route, the solution is a matter of cooperation between highway departments and property owners for their mutual benefit.

In contrast to the old idea of concentrating runoff in ditches and trying to get the water off the right-of-way as fast as possible, today's concept of drainage is recognition of the need for doing everything possible to keep the water dispersed and to reduce erosion by slowing down the movement of water to a velocity that can be handled. Machine methods of flattening, rounding, and mulching of earth slopes are now used as basic operations in a large number of states. These and other related conservation and construction measures are being applied by highway engineers faced with such problems as pumping of pavements, landslides, snowdrifting, and related matters in the economy of highway operations and maintenance.

A point made last year by Carl Izzard, a collaborator of this committee, will bear repeating here. Quoting from page 78 of last year's report:

Two things control the amount of erosion in channels: (1) the depth of the water; and (2) the slope or profile at which the channel is placed. If the slope is fixed, it is the depth of the water that causes the soil particles to move. Anything that spreads the water out and makes the gutter shallower will reduce erosion. *AUTHOR*

Roadside grading and drainage are not separate operations but go hand in hand with erosion control. Since this concept is basic to "built-in" highway safety and economy in maintenance, the following information should be of current interest to highway and landscape engineers concerned with roadside design and maintenance.

In August, 1951, Circular No. 1 "Basic Principles of Highway Drainage" was issued by the Bureau of Public Roads. It was the first of a series of hydraulic information circulars to make available to highway engineers, in preliminary form, the results of studies on hydraulic and hydrologic research. This circular is intended to supplement and bring up to date the experience in this field of highway design and development. Members of the Committee on Roadside Development will be particularly interested in the opening statement in this circular on drainage:

"The cost of maintaining highways in good condition is directly related to the adequacy of the means provided for drainage. Pavements may fail because the load-carrying ability of the subgrade is reduced by the presence of excessive amounts of

water in the soil. Stormwater falling on or draining in the highway may cause severe erosion of slopes, shoulders, and channels, and may undermine culvert outlets. Floods may destroy bridges and embankments.

"Good drainage design depends on anticipating where surface runoff or ground water will occur, in what amount, and how often, and make provision for removal of excess water as rapidly as is necessary to avoid undue interference with operation of vehicles or excessive cost for maintenance. This circular summarizes the latest information on estimating the magnitude and frequency of flood flows from large and small watersheds. It presents new and simplified techniques to facilitate the design of open channels, culverts and bridges to handle such flow safely."

Roadway drainage in humid and arid regions and the design of ditches and gutters are summarized on pages 17 to 22 of this circular, copies of which may be requested from the Bureau of Public Roads.

Another outstanding contribution to the conservation objectives of the Committee on Roadside Development was the paper "Coordination of Water Resources Projects and Highway Development" presented before a Joint Meeting of the Committee on Bridges and Structures and the Subcommittee on Legal Affairs at the Thirty-seventh Annual Meeting of the American Association of State Highway Officials held in Omaha, Nebraska, October 26, 1951. Mimeographed copies of this paper were recently distributed to roadside engineers through the "Clearing House." This presentation on pressing problems of conservation was based on the conclusion permeating the report of the President's Water Resources Policy Commission, published early in 1951, that there is a need for close coordination of effort by federal and state water resources and highway officials from the earliest stages of water-project planning.

The "Definition of Coordination and Examples of Coordination by Highway Officials" will be especially appreciated by roadside engineers. It is not necessary to go into the paper in detail here but members of the Committee on Roadside Development will be interested in knowing that the pioneer work in roadside demonstration projects by the states in the early 1930's is cited as illustrations of coordination of water resources projects and highway development. Landscape engineers will find also of interest the discussion (pp. 14 and 15) of highway design and construction as an aid to soil and water conservation. Pertinent portions of this paper of interest to roadside engineers are included with these notes, (see appendix B), together with an outline prepared in 1951 by one of the state soil conservation committees. This outline shows how increasingly conscious people are becoming of the importance of water conservation, not only in its erosion-control aspects but from the standpoint of adequate water supply. Much attention is being given to pollution abatement in streams and other phases of the problem, but it is being quite definitely demonstrated that soil conservation practices, including ponds and other retention structures, can have a very appreciable effect on increasing ground-water supplies as well as decreasing peak flow and tending to make normal stream flow more constant. The increased interest in farm ponds and occasional site of water impounded along highway fills has suggested the further use of this idea as a means of increasing the number of ponds and the amount of runoff intercepted. In appendix C are notes on this question: "Can Highway Fills, Culverts, and Bridges be More Effectively Used as Water Retention Structures?" The Committee would appreciate receiving from members and others any particular ideas they may have on this timely subject.

In closing these remarks on current developments in the concept of conservation, a portion of the conclusions found on page 15 of the AASHO paper "Coordination of Water Resources Projects and Highway Development" are included:

"At this moment in the crossroads of time, as we review the past and the

current problems arising out of water resources projects and highway development, and as we look toward the future and see new horizons of opportunity for increased public service arising before us, we reach at least one inescapable conclusion. The public interest requires that officials of water resources agencies and of highway agencies at all levels of government must work closer together as a means of enhancing the value of their respective contributions to the taxpayers whom they serve....

"In measuring the value of any particular governmental program, our Nation's taxpayers are looking more and more not only at the achievements of that program standing alone but also at the extent to which it and other governmental programs produce harmonious results. Let us, therefore, as representatives of highway agencies, close ranks with representatives of the water resources agencies at all levels of government, and in the public interest accept the responsibilities which this Nation and its people are placing before us."