

EROSION CONTROL IN ILLINOIS

BY JOHN S. CRANDELL, *Professor of Highway Engineering*
University of Illinois

Experiences with erosion control vary with the parts of the country, the types of soil encountered, the rainfall, and flood conditions which may be encountered throughout the land.

The U. S. Department of Agriculture issued (September 1938) leaflet number 164 on erosion on roads and adjacent lands. This indicates that erosion is widespread throughout the nation. As the author says, "many local roads, and there are 2,684,570 miles of them, are severely damaged by erosion and are in need of repair. They are often most damaging to adjacent agricultural land."

A recent report¹ of the Subcommittee on Erosion of the Joint Committee on Roadside Development on a survey of erosion control indicates the following general rating of control methods.

"A hasty analysis of the various replies in this summary indicates the following general rating of soil erosion control methods:

- 1 Desirable cross sections
- 2 Topsoiling
- 3 Berm ditches
- 4 Seeding
- 5 Mulching
- 6 Sodding
- 7 Paved ditches
- 8 Fertilizing
- 9 Planting
- 10 Drop inlets
11. Ditch checks
- 12 Underground drainage
- 13 Wing and outlet ditches

The reports in this general survey come from such widely different places as Denver, Colorado, Hartford, Connecticut and Tallahassee, Florida.

In this report I shall give a short description of what has been accomplished in Illinois where considerable trouble has been experienced. Erosion control is

handled by the Maintenance Department. It had been thought before any considerable work was done that possibly the northern end of the state would be free from erosion troubles. But it now is apparent that erosion occurs throughout the entire area. Mr. L. H. Hendrick, Assistant Engineer of Maintenance, to whom I am indebted for much of the information which follows, says that basically the problems fall into two classes: first, the washing away of soil from highway fills and highway ditches at locations where soil replacement by maintenance forces is necessary; second, the washing of soils from areas adjacent to the highways on to the highway right-of-way in such a manner as to fill in ditches, culverts or other highway structures and to deposit the sediment in highway ditches, on shoulders and on pavements. He also mentioned the washing of soil down the steeper grades and slopes and its deposition at points where the grade lines of the highways or of the stream channels flatten out.

One of the numerous schemes devised for controlling excessive erosion is to be seen near Murphysborough. This consists of what are called "whisker dams" where straw is bedded down to prevent erosion. The growth is seeded underneath the straw and the cost of the procedure seems to be about two cents per square yard. It is usually necessary to plow a furrow on top of the slope to let the water into a concrete drain. The slopes themselves may vary depending upon the type of material of which they are made. This may readily be visualized if we think of clay of some types requiring a 4:1 slope while loess requires a perpendicular cliff-like slope. Apparently if the slope is 2:1 or more, considerable sodding will be required. Here it has

¹ Roadside Development bulletin, 1939, Highway Research Board,

been found that the planting of lespedeza is satisfactory. This plant grows rapidly with tap roots and it acts more or less as a vine. In other locations honey suckle and other shrubs have been planted and these have, in the main, given satisfaction. On fills it has been learned that willows are giving very satisfactory results. These are started by simply inserting twigs into the ground where sufficient water is present to permit them to grow. Sometimes it is found that the planting of these various vegetable growths is not sufficient and that the soil moves anyway.

A combination of road oil and soil frequently gives the result desired. Here it is necessary to get the proper blend of oil and earth, or oil, earth and gravel. In southern Illinois earthy materials mixed with a proper amount of oil have given excellent results. There is considerable to be done in devising some means for determining the correct proportioning of these ingredients.

Some years ago I was interested in noting that at Syracuse, New York, a mixture of earth and tar gave excellent results, both from the standpoint of making a third class highway, and of preventing erosion. As I was at that time interested in the sale of tar, I endeavored to introduce similar methods of road building and erosion control in other parts of the state and, in fact, in other states, only to find that the scheme did not work. It was the particular soil around Syracuse which seemed to be susceptible to tar treatments and this fact insured success. I believe the same thing is true of road oils. The type of soil, the type of road oil and the climate must be investigated before we can have any assurance that the stabilization of cuts and fills with these materials will be assured. In the Illinois work there have been some partial failures with oil mixes, but on the whole the work has been satisfactory. In the southern end

of the State an entirely different soil is found and the proportions mixed with oil are different from those in and around Chicago.

Mr. Rodney Bell uses what he calls "potato ridges." These are merely ridges shaped like potato hills placed along the tops of slopes to prevent the water rushing down the slope to the highway below. Ditches may be protected by building dams of concrete or of creosoted timber. Great care, however, must be taken to see that these structures are not undermined.

For this work to be effective the cooperation of the farmer is necessary. He should learn to plant his crops in such a way as to conserve the water on his fields rather than to permit it to flow to the ditches in less time. In other words, the rows should be planted on the contours of the land. German farmers have been doing so for a century, and in traveling through that country it is astounding to see the side hill planting, apparent everywhere, which protects and conserves to great extent the soil which has been so patiently and carefully built up for many, many years. In Switzerland I noted that the mountain sides were always planted more or less like our own rice fields so as to make each row a dam.

Mr. Hendrick suggests the use of drop-inlets at the upper ends of culverts. He says

"As the growth level rises around the inlet, the effective height of the fill is proportionally decreased and the fill slope is flattened. Soil washed off of fill slopes or shoulders is caught at the foot of the fill and is not entirely lost to use. This also has the effect of preventing the soil from accumulating in the stream channel below the highway. Drop inlets have been constructed from fifteen feet in height, with the resultant filling in of holes to elevations which permit standard cross sections of the highway on the upstream side of the fill. It is noticeable that in the majority of locations where this type of work is required the drainage structures beneath the highway are of mod-

erate size, very seldom exceeding 36 square feet of area. Inlets for two-foot and three-foot square or smaller culverts may be constructed of concrete, segmental precast concrete block, vitrified clay pipe, concrete pipe or metal culvert pipe. It is the practice of this Department to provide drain holes which permit the drainage of impounded water. This prevents softening of the highway fill and also prevents the breeding of mosquitos. In the southern part of the State a large number of drop-inlets have been constructed by the use of keystone shaped concrete block manufactured under the direction of the Department. The inlets are raised gradually as the ground line rises thus spreading the cost over a long period of time."

For controlling erosion in highway ditches, checks built of concrete or rubble stone are usually employed. The location and number of checks constructed depend on the grade line of the pavement, nature of soil and depth of ditches. It is sometimes necessary to resort to drainage through pipe lines.

Since the beginning of the construction of the present highway system, it has been found necessary to modify the designs of grade line and cross section slopes, in order to minimize the serious results of erosive action, as well as to secure additional safety and more pleas-

ing appearance. In many cases defects of design are not discovered for a number of years after the highways are built. It is important to study the imperfections of designs in order to avoid repeating errors. It is a duty of the maintenance engineer to constantly study highways which are under his care and to search for locations where unsatisfactory conditions exist and then to call attention of construction and design engineers to these locations in such manner as to afford them opportunity to improve future designs.

The study of erosion control is one which involves mathematics, engineering, common sense and human nature.

It is interesting, in looking over the editor's note which was given at the beginning, to see that engineering structures such as underground drainage, wing and out-let ditches, and similar features take the last places whereas such items as top soiling, weeding, mulching and sodding apparently are of far greater importance. This should give the engineer some food for thought, and he should endeavor to modify his ideas to conform to what is herein suggested.