# THE 5,000 YEAR WAR:

# Fighting the Erosion Battle from Antioch to Alabama

[NCHRP has recently issued two research reports on Erosion Control During Highway Construction. The introduction to one report gives a fascinating glimpse into the historical background of a universal problem.]

Since ancient times, people have been aware that rain and wind move soil from bared land. Throughout the world, some people have always sought, by one means or another, to prevent this loss. The remains of erosion-control structures that antedate the Christian era can be found in hills above the acient city of Antioch in Syria. Steeply sloping land in Ireland is protected by stone hedges, some of which were constructed on contours and are believed to have been built with stone cleared from the land more than 5000 years ago. The vineyards in the valley of the Rhine and the rice paddies in the mountains of the Philippines have been terraced for centuries. In Peru 400 years ago, the Conquistadores found the Incas farming steep Andean slopes on terraces walled with stone. Computed on the basis of present labor cost in the United States, many of these terraces would be worth more than $40 000/acre.

In this country, alert people have tried to protect their land from erosion since the earliest colonial period. By 1769, George Washington was experimenting with erosion control methods in connection with farming at Mt. Vernon. Following the Revolution, Patrick Henry declared that "since the achievement of independence, he is the greatest patriot who stops the most gullies." The concern about soil erosion and its control felt by colonial leaders failed generally to permeate the ranks of American people. There was a misleading abundance of good land, and communication facilities for diffusing information were grossly inadequate. Accordingly, for nearly two centuries the average American was either unaware of, or surprisingly apathetic toward, the progress of destructive erosion on the nation's lands. Conservation practices now regarded as fundamentally good land management failed to find a place in the exploitive uses of the land that attended the development of this country. Not until the last three or four decades have Americans begun to regard soil conservation as being prerequisite to sound land-management practices. Nevertheless, throughout the history of this country runs a thread of erosion-control effort.

Early attempts to control erosion tended to lean largely toward a single method of control. In a number of places, terracing was regarded as a complete defense against erosion and was employed rather extensively. It is now known, of course, that, although terracing is an important erosion control measure, it is only one of the many measures that, if used in combination, provide the most effective erosion control. Until rather recently, vegetative methods of erosion control were given scant attention and were only incidentally applied to the land. The use of mechanical and vegetative measures in mutual support of each other was infrequent and usually accidental. By comparison, present-day concepts of soil erosion control involve the integrated and systematic use of not

***Straw bales are used to retain sediment within construction site.***

one but many mechanical and vegetative measures, applied in accordance with the particular needs and adaptabilities of the various kinds of land requiring protection.

Serious interest in water and wind erosion control in relation to roads began in the United States with the advent of the automobile and hard-surface highways. The federal government and some states have been concerned for several decades about soil erosion caused by highway construction and its deleterious effects on the stability of the highway, as well as on off-site values. Most states, however, have been concerned about soil erosion from highways for a somewhat shorter period of time. Current interest and activity in erosion control during highway construction vary greatly from state to state and seemingly depend to a great extent on the customs and values with which people have grown up. If their streams have always run clear, they wish to keep them clear. If their streams have always carried a sediment load, they may be less concerned about a little more sediment as a result of highway erosion. These philosophies are reflected in present-day regulations and restrictions of the various states regarding requirements for controlling erosion from construction sites, including highways. A few states have passed restrictive legislation governing the control of soil erosion even to the extent of making it illegal to permit soil eroded as a result of construction to enter a stream. In most states, legal requirements for erosion control are not very restrictive. In some, they are not even regulatory.

Water that falls as rain and snow on the watersheds of America is one of her most important natural resources. As this water moves down the great river systems, considerable effort is directed toward regulating its flow to serve the numerous uses that depend on it. Increasingly, people become aware, often painfully so, that the amount and condition of water flowing in the river systems exert tremendous influences on individual, economic, social, and recreational affairs.

Most of the interest displayed over water flowing in river systems is related to development of facilities to control it and put it to use after it enters larger tributaries and main streams. Unfortunately, there has been much less concern about controlling water—and the soil erosion it can produce—where it is most susceptible to management control, namely, where it first falls on the land. Experience in many places has shown that a change in the disposition of only a small portion of the water received on the land may greatly affect the manner in which it is delivered as stream flow. The behavior of water and whether it is beneficial or harmful depends, in great measure, on the condition and uses of the lands from which it drains.

The placement of a highway in land that is susceptible to erosion can be expected, without doubt, to cause erosion unless precautionary measures are taken. The general nature of the effects of highways on erosion and sedimentation are known, and include the following kinds of problems: (a) development of unsightly cuts and fills

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*1 Crushed stone rip-rap is used as a ditch liner to prevent water erosion.*

*2 This mechanical blower, used to mulch highway embankments, is the culmination of 5000 years of erosion control.*

*3 Protection by a diversion ditch is reinforced by mulching and seeding the slope.*

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that have been riddled by uncontrolled erosion and gullying; (b) undermining and collapse of fills, structures, and hillsides; (c) unsightly deposition of sediment in streams, channels, structures, ponds, reservoirs, and along highway rights-of-way; (d) destruction of aquatic environments in nearby lakes, streams, and reservoirs caused by erosion and/or deposition of sediment; and (e) destruction of vegetation by burying or gullying.

Numerous practical measures, including the use of berm ditches, mulching, vegetation, surface drainage, structures, sediment traps, and debris basins, have been employed to reduce erosion during highway construction and to prevent sediment from reaching streams. Erosive forces that are prevalent during construction should also be considered following completion of construction activities.

The NCHRP research study showed that throughout the United States there is a great variation in the interest in, and the need for, studies of erosion control on highway rights-of-way during the construction period. Some of the variations are due to differences that exist naturally in soils and climate, and others can be attributed directly to differences in attitudes and opinions of individuals who are responsible for the work. An important fact observed during the numerous visits made to construction sites throughout the country is the importance of the attitude of construction personnel toward controlling erosion. Written specifications, no matter how rigid or detailed they may be, are not effective unless enforced.

Technology is available in the United States to control, within reasonable limits, the erosion and sedimentation that may originate on highways both during and following construction. Most erosion control studies conducted throughout the country to date have been on surface soils for range, forest, and agricultural interests; thus, data pertaining to erosion from construction sites (primarily exposed subsurface soils) are very sparse. Because most of the available information on erosion control has been produced in fields alien to the highway community, state highway and transportation departments have found it difficult to locate, evaluate, and translate into highway use. This became obvious during the visits to construction sites where it was found that, with few exceptions, each state highway department had tackled the erosion- and sediment-control problems principally on its own without making full use of what is already know. This report is intended to fill the obvious need with the listing, descriptions, and pictures of erosion-control measures that are included in the manual, and with explanations of how to apply existing erosion-control technology to highway problems.

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NCHRP Report 220, ***Erosion Control During Highway Construction: Research Report,*** $5.60; NCHRP Report 221, ***Erosion Control During Highway Construction: Manual on Principles and Practices,*** $14.40.



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