

REPORT OF COMMITTEE ON STRUCTURAL DESIGN OF ROADS

A T GOLDBECK, *Chairman*

Director, Bureau of Engineering, National Crushed Stone Association

A glance back over the past decade reveals great activity in the field of research in the structural design of roads. Problem after problem has appeared, each of great importance and the solution of which, when extended over the thousands of miles of highways constructed, has resulted in a very substantial saving.

At the beginning of the building of the Federal Aid Highway System some thirteen years ago, many doubts existed in the minds of highway engineers as to what constituted proper methods of road design. There were few scientific facts established applicable to the design of roads, constructed of necessity under an extremely wide range of climatic conditions, supported on a foundation, now a swamp and now solid rock, carrying traffic having a wide range of characteristics, changing rapidly in character from year to year and ever increasing in intensity.

The problems requiring solution were so numerous and so vital that the initiation of research on any one of them was apt to be productive of important results. Moreover, there were comparatively few highway research agencies and consequently no particular need existed for a far reaching and comprehensive plan of investigation laid out for the purpose of distributing the work. There were more important highway questions crying for solution than could possibly have been undertaken by all of the highway research organizations in the country.

Perhaps those investigations which have been performed in the structural design field have seemed haphazard, but actually this has not been the case. The research agencies have always had their eyes on those goals whose attainment meant most in the possibility of effecting telling results.

To those who may inquire as to just what the research accomplishments have been and to question as to whether the energy expended has been worth while, let them remember the decided improvements in concrete road design, the thickened edge, the center joint and the establishment of the functions and the proper use of reinforcing steel. Let

them compare the advancing knowledge of subgrades and drainage and the far-reaching effects resulting from the practical application of this information. Let them reflect on the extreme value of the researches in low cost roads and the establishment of the limitations of their usefulness. Let them compare the design of present day motor truck tires with those of ten years ago. Is it not evident everywhere how the trend is toward pneumatic tires as against the old, thin, solid tires with their heavy impact effects? Is it not becoming increasingly apparent how numerous are the vehicles having multiple wheels which decrease the load intensity and better distribute it over the road surface? Unquestionably, these advancements in heavy vehicle design are producing a saving of millions of dollars in our costs of highway upkeep. Intensive research is the foundation upon which these changes have been based.

A huge system of highways is unique in lending itself to the benefits of research, for if an advanced method of design or construction is thereby established, the resulting gain is felt not merely in a short stretch of road, it is multiplied time and again, over thousands and thousands of miles of roads to be constructed or to be maintained in the future. It is this fact which makes highway research of such vital importance. Lack of knowledge, resulting in a comparatively small error in design, when repeated over miles of highways will mean an economic loss of millions of dollars and a corresponding saving, not only is possible, but actually has been made as the result of that work which thus far has been accomplished.

Is it not clear, then, that highway research must go on and now that the agencies and their facilities have multiplied is it not equally clear that systematization, which will focus research efforts on those problems having the highest importance, must produce even more fruitful results than have been obtained in the past?

Your Committee on the Structural Design of Roads firmly believes that research in its field should proceed. Judging from the outline which we are now studying and perfecting the potential advancement in the design of highways seems without limit.

In the past much attention has been directed with admirable effect to the concrete type of road, partly because of the wide-spread use of this popular and deserving type and partly, too, because concrete is a more or less elastic material, which engineers understood and could theorize upon much more readily than with materials of a plastic nature. Research in other types has lagged but changing economic

conditions and the seeming necessity of building roads of lesser importance but of huge mileage makes it desirable that more effort be devoted to the improvement of suitable, but less expensive designs. But the more costly types still have as high importance as ever and this fact is not overlooked in your committee's program of work.

It would be a dreary and boresome performance were I to go into detail regarding our research program which now is being completed. I shall content myself with a bare outline of its contents. There are five main divisions including:

- I. Subgrades and Drainage
- II. Traffic
- III. Climate
- IV. Road Types.
- V. Special Problems

Under each of these there appear a multitude of research projects, some of which have already been worked upon and partially solved, but a majority of which have not been completed or even investigated. Upward of a thousand topics have been listed and no doubt some of them may be subdivided into many more.

So the field of research in the structural design of roads is extensive and there is abundant opportunity for the Highway Research Board to bring about a coordinated and cooperative system of highway research which should net results of tremendous value and importance. There is need for just such an agency as the Highway Research Board for marshalling the increasing investigative efforts of the country and a well-laid out program now seems quite essential to the accomplishment of that end.

THE INFLUENCE OF CLIMATE ON THE BUILDING, MAINTENANCE AND USE OF ROADS IN THE UNITED STATES

F H ENO

Research Professor of Highway Engineering, Ohio State University

It is the province of Sub-Committee No. III of the Committee on Structural Design of Roads, of the Highway Research Board, to prepare an outline of the information regarding the various phases of climate that affect the building, the maintenance, and the use of highways