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RESEARCH LABORATORY REPORT

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By

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The Michigan State Highway Department, over a period of years has realized the value of research and has contributed valuable information to the art and science of highway building. Further evidence of the importance of research in the highway industry is manifested by the establishment of a separate organization by the administration for the express purpose of conducting certain research activities of the Department. This research organization with laboratory facilities is located in Olds Hall of Engineering at Michigan State College.

The activities of the research organization are devoted to specific problems arising within the several technical divisions of the Highway Department, as well as comprehensive laboratory and field studies carried out on a long range plan.

The Research Program

The research program is comprised of primary problems pertaining to higher quality concrete and bituminous pavements as well as subgrade investigations and soil stabilization. In regard to concrete pavement, special emphasis is being placed upon such subjects as, scaling, curing, design, including slab thickness, spacing of joints, joint design and concrete mix design. The changes in characteristics of binding medium and consequent development of specifications for binding material are being considered in connection with bituminous pavements. Subgrade and soil studies involve measurement of subgrade modulus, relation of characteristics

of subgrade soil to supporting value and methods of soil stabilization. The outstanding research work accomplished during the last two years will be summarized under laboratory and field projects.

Laboratory Projects

Among the laboratory projects are the determination of certain factors relating to durability of concrete, particularly scaling which involves "break down" tests on various neat cements, cement mortars, concrete mixtures containing various admixtures, and the chemical reaction between chloride salts and the hydration products of set cement.

Studies pertaining to changes in characteristics of bituminous materials secured from field test sections are being continued in an attempt to correlate weathering characteristics of the bituminous materials with accelerated laboratory durability tests.

Certain preliminary studies incidental with the construction of soil stabilization projects as well as subgrade bearing capacity studies have been performed.

Laboratory studies pertinent to the activities of the other divisions have received their due share of attention, such as, concrete admixtures, joint sealers, flight strip design, traffic paints, reflectorized sign marking material and concrete membrane curing.

Field Projects

It is considered essential to construct test roads to serve as field laboratories for supplementing the laboratory work. In this connection, several field test projects have been completed during the past biennium

involving studies pertaining to the design and durability of concrete pavements, soil stabilization and vibrated concrete. The most outstanding field project completed is nationally known as the "Michigan Test Road".

The Michigan Test Road: The test road was constructed by the Michigan State Highway Department on M-115 between Farwell and M-66 by regular contract and construction procedure. The project consists of 17.6 miles of 22 foot concrete pavement in which there are included all of the latest ideas of modern concrete road construction. Ten miles of the test road are devoted to such factors in design as spacing of expansion and contraction joints, uniform slab thickness, cross section versus thickened edge cross section, amount of reinforcing steel necessary, relation of cross section to subgrade supporting value, cross section thickness and the prestressing of concrete slabs during curing. Construction factors incidental to the particular test section are the mechanical handling of concrete, mechanical tamping of forms, vibration of concrete at joints and the use of several different types of joint seals.

The remaining 7.6 miles of the test road are devoted to a durability study of concrete. In this section the constituents which affect the durability of concrete have been varied to include such factors as, the grading of the aggregate, the design of the concrete mixture, the change in physical and chemical characteristics of concrete as influences by the addition of various types of admixtures with the Portland cement, the use of various finishing methods and different methods of curing.

Since its completion, the test road has been under constant surveillance, including condition surveys, special measurements to detect slab

movement and physical condition of the concrete, subgrade bearing value, and accelerated scaling studies on the durability section. Periodical reports are being made as the study progresses.

Soil Stabilization: Soil stabilization is the process of giving natural soils enough abrasive resistance and shear strength to accomodate traffic or loads under prevalent weather conditions. Two experimental soil stabilization projects were constructed to determine the feasibility of stabilizing the existent road base material with portland cement or appropriate bituminous binders and to develop specifications for the use of the Department in constructing such types of road surfaces.

A three-mile soil-cement stabilization project was constructed on M-92 north of Stockbridge. The other project consisting of 2 miles of soil-cement stabilization and 4 miles of sand-bituminous stabilization was constructed on M-72, Grayling east. The materials in each case were entirely different in character.

Vibrated Concrete: The latest design of vibratory equipment was given a trial on M-114 near Grand Rapids. In addition, certain construction features pertinent to slab design were included in the project, such as single lane construction, uniform slab thickness and no steel reinforcement.

Other Projects: Other field projects of special interest to the Department were constructed throughout the state including a special study of stone sand construction at Manistique.

Technical Reports

During the past biennium, the research organization has participated in the activities of the various technical societies, including the

presentation of numerous papers. The 30 odd papers which have been submitted by the organization consist of technical papers, specifications, progress reports and final results pertaining to specific problems. In addition, 45 preliminary reports have been prepared by various members of the research organization pertaining to definite phases of the research work in which they have been actively engaged.

Cooperate Research Project at Houghton

In December 1941, a cooperate research project was established between the Michigan State Highway Department and the Michigan College of Mining and Technology at Houghton, Michigan. The project was established for the purpose of using the laboratory facilities of the college for convenience in investigating the problems of immediate concern to the construction of highways in the upper peninsula.

The research program as established has a twofold objective, first, to carry out local research problems of vital interest to the Department's general research program and, second, to study the possibility of adapting certain mine waste products to highway construction.