Results

1 A 1 3 Portland cement mortar was weakened 50 per cent by saturation
2 It was also proved that the weakening resulted at once, indicating that the cause was physical and not chemical.

"Saturation of Concrete Reduces Strength and Elasticity" M B Lagaard, Emergency Fleet Corporation, Philadelphia, Pennsylvania. Engineering News-Record, 1918

Results

1 Reduction of strength of 35 per cent when concrete is saturated
2 Saturation slightly reduced the modulus of elasticity Age of concrete up to two years does not seem to change this relation.

TABLE SHOWING REDUCTION IN STRENGTH DUE TO ABSORBED MOISTURE

(From tests by Minnesota Highway Department, 1922)

Coarse aggregate	Compressive strength lbs sq in		Difference in strength between wet and dry concrete, in per cent
	Dry	Wet	
Granite	5320	3464	−34 8
Gravel	5150	3330	−35 4
Gravel	4848	3380	−30 2
Gravel	4334	3093	−28 6
Quartzite	4894	3110	−36 4
Granite	4405	3910	−11 2
Gravel	4422	2749	−37 8
Limestone	4269	3895	− 8 8
Granite	4828	3280	−32 1
Trap	4140	4467	+ 7 9
Trap	4340	3016	−30 5
Quartzite	5308	3649	−31 2
Quartzite	4630	4910	+ 6 1
Granite	4735	4353	− 8 1
Gravel	4443	4535	+ 2 1
Granite	4651	3695	−20 6
Granite	4520	3323	−26 4

EFFECT OF GRADING OF MINERAL AGGREGATES IN SHEET ASPHALT AND BITUMINOUS CONCRETE CONSTRUCTION RELATIVE TO DEFORMATION OF SURFACES UNDER TRAFFIC

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A report on this problem necessarily is one of progress

Only a small amount of experimental data on the subject is to be found in published literature, although considerable has been written

discussing the matter in a general way and emphasizing the need of more information Appended is a brief list of references to published discussions of bituminous mixtures which deal with stability of the pavement, at least in part

The first phase of the problem for which a solution is required before those engaged in research on bituminous mixtures can hope to begin accumulating data on the problem itself, is the development of a suitable test or tests for mixtures which can be interpreted in terms of the behavior of compressed bituminous mixtures under traffic It is mainly upon this first phase of the problem that attention is being concentrated Considerable progress has been made, and it is hoped that within the coming year a definite method of testing compressed bituminous mixtures may be found, and that studies of the relation of the many possible variables in mixtures to action under traffic will be under way

RESEARCH UNDER WAY

Bulletin No 21 of the National Research Council lists a number of investigations which involve the subject of aggregate gradings These may be found on pages 48, 54, 79, and 80 Those conducted by the Texas A & M College and by the Commissioners of the District of Columbia may be considered as completed investigations, although the District of Columbia reports that additional work may be done during the coming year No further information is available regarding the study of asphaltic concrete mixes conducted by the San Francisco Department of Highways and Streets The Omaha Testing Laboratories have been investigating gradings to obtain minimum percentage of voids, starting with a maximum size aggregate and adding increments of the next smaller size to secure the mixture of the two sizes with minimum voids, then proceeding with still smaller sizes in the same manner A great deal of data has been obtained, but, so far as is known, it has not yet been published

The Pennsylvania State Highway Department with cooperating agencies has under way an investigation of fine-graded mixtures, under the direction of a committee of the American Association of State Highway Officials The tests for character of the mix are made on small compressed cylinders and include toughness tests at low temperatures, and deformation tests under static load at high temperatures. A great deal of data has been accumulated with various asphalts, percentages of filler and asphalt and sand-gradings as variable factors of the mixture.

The U. S Bureau of Public Roads has under way investigations designed to establish suitable methods of testing bituminous mixtures as to their resistance to displacement and the relation betewen displacement and various factors in the mixture and its compaction. Various physical methods of testing specimens have been tried out with varying success, none of them has as yet proved entirely satisfactory. At present the work is concentrated on the problem of a suitable test, which is admittedly difficult of solution, and will involve a study of a reliability

and range of test results accommodating the many possible variations in bituminous mixtures.

A second series of experimental sections is being tested on a circular track under controlled truck traffic. This series includes 28 sections of sand mixtures wherein sand-grading, type, penetration, and percentage of asphalt and percentage of filler are varied, and five sections of asphaltic concrete in which the percentage of asphalt is varied A previous series was made up of asphaltic concrete sections. Investigations on this track primarily are for the purpose of correlating laboratory tests on similar mixtures with observed behavior under traffic, and although the several mixtures may be directly compared, there are important departures from standard practice in pavement construction Corollary investigations of pavement temperatures are being made

During the past year, The Asphalt Association has conducted an investigation to develop a simple test for stability for use in laboratory and paving plant The apparatus has been described and the results of preliminary series of tests have been given at a recent conference on asphalt paving held at Louisville, Kentucky [1]

The test is a type of shear or plasticity test, and the results are very promising as to its value in studying bituminous mixtures

DESIRABILITY OF FURTHER RESEARCH

The fact that further research on factors influencing the behavior of bituminous pavements under traffic is desirable and essential to our keeping abreast of changing traffic conditions has been emphasized many times at engineering meetings and in discussions The design of bituminous mixtures is a difficult problem to solve, as not only do many possible variables in the components and proportions of the mixture necessitate a very extended research in order to cover all phases of the subject satisfactorily, but also many other factors outside of the mixture itself have an important bearing on the subject There is no doubt that in many cases the failure of inferior pavements to give satisfaction has been ascribed to defective mixtures when the causes should have been placed more properly on insufficient consideration of the width of street, traffic, exposure, or upon faulty construction methods

Research upon the properties of bituminous mixtures should be encouraged and the first thing to be considered in such research is the development of methods for testing which will give the information desired.

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RECOVERING BITUMINOUS MATERIAL FROM AGGREGATES WITHOUT CHANGING ITS CHARACTER

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In presenting a report on this subject, the writer has attempted to collect published methods on the subject and opinions from various authorities engaged in this field of investigation with the object of presenting a summation of what has been accomplished on the problem In the general study of the life of highway surfaces, the desirability of having a reliable method by which bitumen could be recovered with the certainty that it had not been changed in the recovery operation is apparent to all, but although several methods have been published, there is comparatively little data available to show exactly how much reliance can be placed on the results of tests on the recovered product The methods which have perhaps had the largest publicity are presented in the order of their publication

A W Dow [1] appears to have first outlined a definite procedure, having in mind principally the recovery of the pure bitumen from native asphalts carrying high percentages of mineral matter, with the notation of its value for the recovery of bitumen from bituminous aggregates Briefly, his method involves digestion of the bituminous aggregate in cold carbon disulphide, sedimentation, and decantation of the solution of bitumen, from which the bulk of the solvent is removed by flask distillation, and the last traces by the addition of a very small amount of water and further heating Dow comments as follows

"It is doubtful whether in all cases the last traces of carbon disulphide are removed, even by this method, and it is also likely that the pure bitumen obtained in this way is often slightly harder than that contained in the original asphalt or cement, but its physical properties as far as ductility and susceptibility to change in temperature go, will be relatively the same, and a sufficiently close approximation can be made of the consistency of the bitumen in the original sample to answer all practical purposes"

[1] Proc A S T M 1903, Vol 3, p 360