If the failure of concrete under fatigue is due to working the cement back and forth through a plastic range, the time flow should be known

For this inquiry one beam was subjected, as in Figure 2, to a continuously applied static load on one side of the straining beam for 11 weeks to date, that is, 50 per cent of static breaking load for 7 weeks with no appreciable effect and 75 per cent for 4 weeks

Figure 12 shows the results for a specimen of age 18 months. The deformations are the sum of the tension and compression deformations without regard to sign.

The temperature of the laboratory which would drop 10° F. in one day will throw an extension to a compression as shown on the instrument If the temperature of the concrete were known, temperature corrections could be applied. When the heat was turned on in the laboratory the beam became drier and shrunk, this again changed the readings.

By recording the sum of the deformations on each side (tension and compression), the uniform changes of length due to temperature and to shrinkage are eliminated

The total unit time flow to date, three weeks duration, is 0 000087 for 75 per cent of static strength The increase ceased at 1½ weeks The unit deformation under reversed stresses for this age of concrete at the 55 per cent of static load was 0 0003 or nearly 3½ times as great.

THEORY OF STRESSES IN ROAD SLABS

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A theoretical investigation of stresses and deformations in road slabs on the basis of mathematical theory of elasticity has been carried on for the U. S. Bureau of Public Roads by H M. Westergaard of the University of Illinois The progress of this work was reported at last year's annual meeting The work has been continued, with interruptions, during the present year, and a report of the results which have been obtained so far is now under preparation for publication This report takes up the following subjects (I) general principles and methods of the analysis; (II) the corner break, (III) deflections and stresses which are caused by wheel loads at a considerable distance from the edge of the slab; (IV) corresponding results for wheel loads at the edge, (V) effects of changes of temperature, especially the blow-up of the road slab due to expansion, and (VI), in the form of an appendix, particular features of the theory and method.

The analysis leads to diagrams of such deflections and moments as are due to wheel loads which act either at an appreciable distance from the edge or at the edge By comparing the contour lines which have been obtained for the deflected surface by tests and by theory, respectively, numerical values of the elastic constants which are involved, especially a certain constant which measures the stiffness of the subgrade, may be determined in any given case. The relative stiffness of the slab and the subgrade is of consequence, in regard to the distribution of deflection, moments, and stresses. When the measures of stiffness are known, numerical values may be computed by the methods which have been developed. Difficulties were encountered, especially in dealing with the rather complex states of stress which are produced in the immediate neighborhood of a concentrated wheel load A method of computing the tensile stress at the bottom of the slab directly under a wheel load has been obtained, however. The computations showed that the essential portion of the maximum stress which is caused at this point by the loads is due to the wheel load immediately above the point The analysis showed also that the size and shape of the area of contact between the tire and the slab, and the distribution of pressure within this area, have influence upon the maximum stress With constant thickness of the slab, a wheel load placed at the edge produces considerably larger deflections and stresses than does the same load placed at an appreciable distance from the edge. By comparing the numerical values of stresses which are found in this way in the two cases for different thicknesses of the slab, one obtains indications as to a rational proportioning of thicknesses at the edge and at the middle The most favorable ratio of thicknesses as found in this manner, is dependent on the relative stiffness of the subgrade and on the character and exact distribution of the load

The application of the theory of a beam of uniform strength to the case of a load at a corner, such as is formed by the edge and a transverse crack or joint, offers a suitable first approximation for determining important stresses, and represents, indeed, the most important single step in the investigation of the mechanics of road slabs. A load at a corner produces tension at the top of the slab With uniform thickness of the slab this tension is larger, except under extraordinary circumstances, than the tension which the same load would produce at the bottom of the slab when it acts at a distance from the corner and from the edge Also, the tension at the corner may be larger, depending on the character of the load and the relative stiffness of the subgrade, than the tension which the same load would produce at the bottom of the slab when it acts at the edge, but at a distance from the corner

For the purpose of further investigation in the theory of stresses in road slabs, information is desired concerning the areas of contact between the tires and the slab and concerning the distribution of the pressure within these areas

The suggestion is made that further theory be developed, first concerning the state of stress due to a load which is distributed over a small area near the corner, that, secondly, theory be developed regarding the influence of the gradual variation of thickness from one point to another, and, thirdly, that the question of the dynamical action of the slab under impact load be taken up from the point of view of the theory of vibrations