1 That the soil adulteration with cement or lime compounds is not an efficient or economical method of securing stability in heavy soils
2 That the suitability of soil for subgrade purposes, or of the merits of various methods of soil treatments can be determined by relatively simple laboratory tests and that expensive field tests can in some cases, at least, be avoided by first resorting to a properly conducted laboratory investigation
3 That a sand or gravel layer is an efficient and economical method of minimizing damage to pavement resulting from swelling or shrinkage of the subsoil"

DISCUSSION OF REPORT OF COMMITTEE ON STRUCTURAL DESIGN OF ROADS

Led by Clifford Older
Consoer, Older and Quinlan, Chicago, Illinois

It has been a great privilege to listen to the briefs of the results of such a vast amount of intense research work I will not attempt to enter into a detailed discussion of any of the papers Two thoughts occur to me, however

One comes from a realization of the volume of the data represented by these briefs. I am inclined to believe there are many engineers who, for lack of time to study such data for themselves, would gladly welcome and accept such interpretations as the authors might see fit to make It would seem to me, therefore, that it would be a boon to many busy engineers to have available a concise discussion of the significance of the data accumulated as interpreted by the authors

The other relates to the research possibilities that might be developed along the lines of Mr Hogentogler's investigation of the service value of reinforcing steel in concrete pavements The laboratory investigations of Dr. Hatt and Mr Breed show possible advantages of using reinforcing steel in percentages so small that in accordance with theories heretofore generally accepted, its strengthening value would ordinarily be neglected The condition survey made by Mr Hogentogler of pavements reinforced with comparable percentages of steel shows the unmistakable advantage of such reinforcement Many engineers who might hesitate to accept laboratory results, except those of the most positive character, would not hesitate when such results are confirmed by an extensive survey of field behavior

It appears to me that condition surveys along other lines might add greatly to our knowledge of pavement design For example, we have listened to an excellent paper on subgrade investigation Unquestionably there is a vast amount of information available concerning the behavior of subgrade soils, and yet may I venture to say that our knowledge of what this means with respect to the behavior of the pavements laid upon them is very meagre The suggestion I have to make, then, is a condition survey with the view of correlating soil classification and pavement condition We believe that the character of the subgrade has a marked effect on the load-carrying capacity of pavements and yet we have no quantitative measure of such effect The first real indication is Dr Westergaard's theoretical analysis of the stresses in pavement slabs This points out some important facts that should help us to evaluate the effect of subgrade variables From his paper it would appear that a variation in the subgrade stiffness factor of possibly as much as 400 per cent might result in a stress variation of perhaps only 25 per cent in a pavement of the design analyzed

It appears to me that a large scale condition survey, having in mind subgrade variables, together with Dr Westergaard's paper, might enable us to design pavements for differing subgrade conditions with confidence

E R Hoffman (by letter) The experience of the Washington State Highway Department justifies, I believe, a report on the comparative behavior of several types of pavement constructed by this State The original design constructed here (6–7½–6 inches) was 20 feet wide, 6 inches thick at the edges and 7½ inches thick at the center Transverse expansion joints were placed 30 feet apart

In 1919 a short section of pavement was constructed with a longitudinal joint along the center line, a uniform thickness of 6¾ inches and transverse expansion joints at 30-foot intervals A few additional short sections of this design were constructed in 1921 and 1922.

In 1923, about 40 miles of pavement (9–6½–9 inches) were constructed with a width of 20 feet, edge thickness of 9 inches tapering to 6½ inches in 2 feet, uniform thickness of 6½ inches across the center, a longitudinal joint along the center line and transverse expansion points at 20-foot intervals Two miles were constructed the same year of the same general design but 10–7–10 inches instead of 9–6½–9 inches, as stated above Also 10 miles of 7-inch uniform thickness (7–7–7 inch) with a longitudinal joint down the center line and transverse expansion joints at 20-foot intervals

The original design (6–7½–6 inches) first above mentioned, had numerous faults which resulted in necessary repairs that cost money and are also unsightly

The 7-inch uniform thickness with joint down the center and transverse joints at 30-foot intervals served well but developed numerous transverse cracks

The 7-inch uniform (7–7–7 inches) with longitudinal joint and transverse joints at 20-foot intervals has proved to be very good but does not offer the resistance to breaking that the 9–6½–9 inch section shows

The 9–6½–9 inch section has, like all the other sections, passed through at least two severe winters and is giving very good service, has but few repairs, and presents a first-class appearance.

The 10–7–10 inch is the best of all compared on the basis of maintenance costs and appearance

Next year we expect to be able to present additional data based on condition surveys that will present the value of the designs in a more practical way.

Chairman Johnson I wish to announce the membership of the Committee on Nominations as follows Messrs Breed, Hubbard, Ege, Compton, and Eno