Pore Pressures in Compacted Clay*

by

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THE authors have reported pore pressure measurements in compacted and compacted-saturated samples of a clay. The writers have reservations regarding the technique used for measuring pore pressures, and therefore the results reported by the authors.

The authors make no distinction between the pore air and the pore water pressures in their measurements, and have used an ordinary carborundum stone for measuring the "pore pressures". These porous stones have a negligible Air Entry Value (A.E.V. of less than 0·5 p.s.i.g. observed by N.S. Verma—ref. 7).

Compacted samples at optimum moisture content, and dry of optimum moisture content have been observed to have a high value of suction potential by researchers such as Schofield (1935), Schofield (1936), Croney, Coleman and Bridge (1952), Olson and Langfelder (1965), and others. Apparently, a carborundum porous stone cannot retain water when it is in contact with such a compacted sample. Cavitation in the stone occurs within a matter of minutes after saturation by flushing. The writers, therefore, suspect that during the pore pressure measurements in the compacted samples, the stone contained continuous air voids, and that the "pore pressures" reported by the authors are in fact pore air pressures. This view point is substantiated by the fact that the initial pore pressures reported are at atmospheric pressure. At the University of Ottawa, the initial values of only the pore air pressures have been found to be near atmospheric pressures in compacted samples (Verma—ref. 7).

In cyclic loading tests, assuming that the rebound on unloading is less than the compression on loading in a cycle, as is always the case in a real soil, pore pressures cannot fall back to zero if there is no drainage of air or water from the sample. Therefore, on unloading the values of pore air pressure would be greater than atmospheric which would cause the membrane to balloon out. On subsequent loading which would result in a net increase in compression compared to previous loading, the pore air pressure values should be greater than the preceding cycle. In the authors' tests it is to be suspected that air leaked out through the negligible A.E.V.

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porous stone during the test. This explains why the continuous drop of pore pressure is each cycle of loading.

The authors have pointed out that the maximum pore pressure in compacted-saturated specimen was slightly less than compacted specimen. The writers feel that the authors are speaking of two different kinds of pressures in the two kinds of specimens—pore air pressures in the compacted specimen, and pore water pressures in the compacted-saturated specimen, and therefore the comparison indicated is unjustified. The porous stone would remain saturated with water when in contact with a compacted-saturated sample, and the measurements recorded would probably be pore water pressures.

The magnitudes of the pore pressures observed in the authors' tests seem to be more dependent on the amount of air lost during the test than on the properties of the soils. It would be interesting to know the volume change behaviour during these tests and to calculate the changes of pore pressures corresponding to the observed volume changes.

The term "aggregate pore pressures" as used by the authors is misleading. It has been demonstrated by Matyas and Radhakrishna (1968) that pore air pressures and suction pressures have to be regarded as separate and independent stress parameters in partially saturated soils.

Regarding the relationship between the degree of saturation and Skempton's B-factor, the writers have no serious doubt that the B-factor is uearly 1·0 when the sample is fully saturated. Tests on twelve compacted samples (compacted at OMC), which were saturated by application of back pressures, carried out by Verma (1967) show that a pressure of about 60-75 p.s.i. is required to saturate most of the compacted samples. Figure 1 shows the path followed by these samples during saturation. The writers feel that if the authors had used the back pressure technique to saturate the

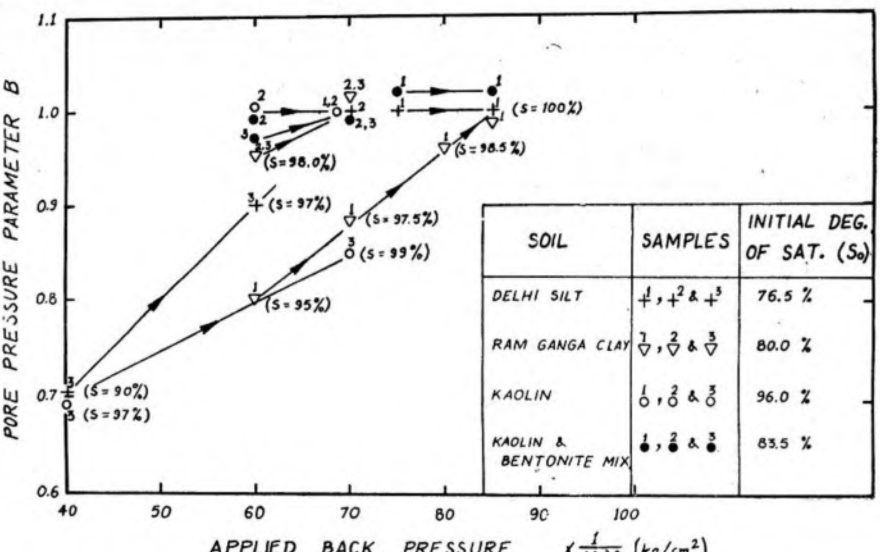

FIGURE 1 : Saturation of compacted specimens by back pressure.

samples they would have obtained a value of B-factor equal to 1·0 for all samples regardless of the structure of the samples.

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AUTHORS' REPLY

In the investigations use of ceramic disc with high air entry value and back pressure technique for saturation were not made because of convictions the authors hold against them. Namely much advocated high air entry value ceramic disc may not transmit the pressures as is believed to pore pressure measuring device. By using the back pressure technique for saturation there is a possibility of certain water entering to the sides of the specimen subsequently when the lateral pressure is applied in the cell around the specimen the water in between the rubber membrane and the specimen is just subjected to this pressure which will be recorded in the pore pressure measuring device. It is to be admitted that this argument is not yet well received and the result is the present discussion. In the absence of separate measurements for evaluating pore air pressure and pore water pressure what we measure in the pore pressure measuring device is the only aggregate pore pressure.

No air is lost during the test as mentioned in the discussions except probably small quantity which might have dissolved in the water because no air bubbles were noticed in the pore pressure measuring system. As there were no facilities for measuring volume charge behaviour simultaneously along with pore pressure.

In the end authors wish to thank the discussors for their stimulating discussions.

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