undoubtedly benefit to a great extent the researchers and designers in the field of water retaining structures.

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A Method for *Minimum Void Ratio of Sand**

by

Manikant Gupta & T.P. Dass

S. NARAYANA RAO**

The authors are to be congratulated for the interesting paper on the "Method for minimum void ratio of sand". The writer has the following points for clarification from the authors :—

(*a*) The authors, in the introduction, have stated that "Standard methods for obtaining maximum and minimum void ratios are not available". In this connection authors attention is brought to the IS : 2720 (Part XIV)—1968 "Determination of Density Index (Relative Density) of Cohesionless Soils".

(*b*) The values of minimum void ratios of different sands are given in Table I. The authors may clarify how and under what conditions the minimum void ratio was found.

(*c*) In page 224. it was mentioned that "Figure 3 is a plot between relative density and number of revolutions, for Solani sand vibrated in Proctor's mould for different accelerations of 0.25 g. 0.5 g. 0.75 g. 1.0 g. and frequencies of 5, 10, 14 CPS". But as per Table II, range of acceleration covered in the tests is 0.25 to 1.5 g. It is not clear why the readings corresponding to 1.5 g. are not shown in Figure 3.

Also, only six curves are shown in Figure 3, when there are 15 combinations of acceleration and frequency. Curves pertaining to the following combinations are not shown :

Acceleration	*Frequency*
0·25 *g*	5,14 CPS
0·50 *g*	10 CPS
0·75 *g*	10, 14 CPS
1·00 *g*	5 CPS
1·50 *g*	5, 10, 11 CPS

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These may be given now to confirm that the results for these ranges are also agreeing with the other results given in Figure 3.

(*d*) The sentence in page 224, "This shows the compaction attained after the table was vibrated for certain number of revolutions" is NOT clear. This may please be clarified.

(*e*) In para 2, of page 224, the word 'Density' is used in the discussion while the 'Relative Density' is covered in the graphs. The authors must be meaning relative density only.

(*f*) The following conclusions can also be drawn from Figure 3 :—

(*i*) For a given frequency the relative density increases with the increase in acceleration.

(*ii*) For a given acceleration, the relative density increases with increase in frequency. The authors may please confirm that test results for other sands also confirm these inferences.

(*g*) In para 1, of page 225, authors have stated that "It is observed from these figures that density increases with an increase in acceleration up to a maximum value beyond which density remains constant with further increase of acceleration". Figure 4, from which this inference is drawn, does not confirm the statement. The final relative density is increasing with the increase of acceleration even up to 1·5 *g*, up to which the tests have been conducted. A clear increasing trend can be seen in all the three curves (5, 10 and 14 CPS). Authors are requested to clarify how the conclusion was drawn.

Also, in the table on page 225, acceleration for maximum compaction (Proctor mould—Solani Sand) is given as 1·75 *g*. Actually the graphs in Figure 4 does not cover for accelerations above 1·50 *g*. The range of acceleration mentioned in Table II is only upto 1·50 *g*. The authors are requested to clarify how these conclusions are drawn.

(*h*) In para 1, on page 228, the authors have stated that, "It has also been previously seen that higher acceleration is required in a smaller mould...". The data pertaining to CBR mould and big mould given in Figure 8 does not agree with this conclusion. The authors may clarify this discrepancy.

(*j*) Figure 9 gives the relationship between Final Relative Density and frequency for Solani Sand and CBR mould. It is not clear why graphs for CBR mould are given in this case, while all the earlier graphs (Figure 3 through Figure 7) are given for Proctor mould. The authors may please confirm that exactly similar trend is seen in case of Proctor mould also.

(*k*) Conclusion 3 namely "Higher acceleration is required for maximum compaction in smaller mould" is to be modified in view of the results shown in Figure 8.

AUTHORS' REPLY

The authors thanks the writer for his interest in the paper.

Horizontal vibrations are found to be much more effective than vertical vibrations in compacting sand. Large parameters are involved in obtaining a maximum density in laboratory under vibrations. Before setting a standard various parameters are required to be thoroughly studied. There is a vide scope in this field.

A series of tests were performed on a particular sand by varying size of mould and vibration parameters. The minimum void ratio obtained was used for calculations of relative densities. The vibration parameters were different for different sands for the minimum void ratio.

The tests were performed on four different sands in three different moulds. Since it was not possible to present all the data in this paper, only few results are given here. Similar trend was observed for the cases that are not included in the paper. For the details the original reference* may be looked into. Few tests were performed at 1·75 g also. Extrapolation was also used where required.

Higher acceleration is required in smaller mould for maximum possible compaction. Figure 8 indicates that maximum density could be obtained in CBR mould. The above trend can be cited in Figure 8 also.

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* DASS, T.P. (1969): "A Method for Finding Minimum Void Ratio of Sand", *Master of Engineering Thesis*, University of Roorkee, Roorkee.