Properties of the diversion channel soil and problems of its utilisation in the earth dam at Ukai*

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Under the heading "Characteristics of the silt" on page 227, samples upto 20 m. depth were reported to have been classified mostly in CL, ML and SM category. However, the test data presented is for shallow depth upto 6.10 m. These soils, as put in a general range by authors do not indicate either utilisation or compactibility characteristics unless these are examined individually. The authors could have indicated the properties of SM soils, alone, which is reported to be 90% of the total soil. A proper investigation of soil profile in the compulsory excavation diversion channel in time seems to have not been done resulting thereby into a problem for zoning and compaction of these soils in dam.

The variation of soils can be seen from the range of density for S. No. 1 to 6, and No. 7, 8, of Table I of the paper. The thickness of the layer has been kept constant for all trials except last two. Further, the Table-I is not in the order of the trials made in the field and the analysis is not scientific, e.g, a lighter sheep foot roller 23.5 kg/cm. sq.) is stated to have no material effect whereas Table below clearly shows relatively better compaction by this roller.

The following Table III based on Table-I shows average values of M.D.D. of the soils, the density achieved in the field after 12 passage and and the percentage compaction obtained by various types of rollers in the order of field trials.

The table III herewith shows that the conclusions drawn by the authors are misleading e.g. the elephant foot roller in Sr. No. (6) is reported to have better performance than in Sr. No. (5) whereas as a matter of fact it is not so. In general Sr. No. (3), (4), (5), (6), and (7) tests show almost identical field performance. It is surprising that the density is fairly constant inspite of wide range of water content.

It does not sound logical to procure a heavy sheep foot roller and cut its teeth to convert it into plain drum roller when the shear strength of silty material was known. The use of silty material is stated to be limited below the drawdown level only (page 230, para 1). This is not correct as

* Published in the Indian Geotechnical Journal, Vol. 4, No. 3, July 1974.
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zone 2A and 2B in the river portion will be subjected to downstream drawdown from maximum tale water level to around 45 metres or so (Souvenir (1972) Ukai Project).

TABLE III

S. No.	Type of roller	M.D.D. of the soil (gm/cm³)	Average density achieve in 12 passes (gm/cm³)	% compaction obtained	Range of m.c. OMC in bracket
1.	Sheep foot roller (47 kg/cm. sq.)	1.62	1.34	82.7	14.5 to 22% (25%)
2.	Sheep foot roller 23.5 kg/cm. sq.)	1.65	1.44	87	14 to 22% (23%)
3.	Converted plain roller.	1.64	1.475	90	14 to 22% (24%)
4.	Pneumatic roller (30 tonnes)	1.65	1.47	89	17 to 29% (21 to 23%)
5.	Elephant foot roller (8.8 kg/cm. sq.)	1.62	1.51	93.2	15.6 to 20.5 (24.5%)
6.	Elephant foot roller (10.28 kg/cm. sq.)	1.62	1.52	94	16 to 22% (23-24%)
7.	Elephant foot roller (12.3 kg/cm. sq.)	1.62	1.47	90.7	15.6 to 20.5 (24.7)
8.	Pneumatic roller (60 tonnes)	1.68	1.62	96.5	19 to 22% (16-21)

The statement on page 233, para 3, i.e. "Heavy pneumatic tyred roller thus appeared to be the right choice for compacting this type of the material" appears to have been made to justify the procurement. The results showing the efficiency of these rollers cannot be judged as the soils are completely different (as seen from MDD and OMC). It is unfortunate that the heavy pneumatic roller also met with the difficulties due to blending of moisture. The wetting of borrow pit areas is again not self explainatory as per Table-II, wherein the field moisture content for shallow depths upto 4 m. indicate in many of the cases NMC > OMC.

To investigate loessic behaviour of the soils sounds funny when the soils on the right bank are alluvial deposits flooded and saturated by the floods in the river during the past. To add to it, for a major project, it is unscientific to decide loessic behaviour by comparing grain size distribution. The U.S.B.R. criterion requires estimation of field density. The authors have not described the method for obtaining the field density, this is important particularly when the soil behaves as a dilatant material. The conclusion as drawn from fig. 3 that, the soil is loessic and unstable is incorrect as uniformity coefficient of Ukai soils cannot be anyway compared to the unstable soils of Terzaghi.

The U.S.B.R. graph should not govern the design as it gives data for shallow depths upto 6 m. whereas the subsoil extends to a depth of 35 m. Unless the sampling technique is highly specialized the results can be misleading.

Conclusion arrived at on page 239, last para i.e. "there were hardly any chances of volume collapse" could have been arrived at even without those studies as the soils are alluvial.

The low values of pore pressure recorded by piezometers are explained by authors by stating "rate of construction was rather slow" on page 241 last para. Is it not likely that the piezometer tips were insensitive to pressure due to installation defect and recording or pore water pressure being difficult due to air entry through the porous disc? It is understood that the instruments installed were hydraulic as well as electronic piezometers. The authors may clarify the type of instrument read and the nature of pressure measured i.e. pore air pressure or pore water pressure. The Hilf formula (computations in Appendix-I, page 244) shows pore air pressure (see Research conference on strength shear, 1960) and is not likely to be comparable with pore water pressure measured in the field.

Reference :

JATHAL, M.N., BUCH D.T. AND PUROHIT, M.V. (1967), "Geotechnical characteristics of the silty soil on the river terraces at Ukai".—*symposium on pore pressure and shearing behaviour of soils.* Vol. II, May 1967, Delhi.

Souvenir, Ukai project (1972), pp. 61-73.

Research conference on shear strength of cohesive Soils, Boulder, Colorada June, 1960, pp. 74-80.