DISCUSSION

A study of the variation and effects of water pressures in pervious strata underlying Crayford Marshes

A. MARSLAND and M. F. RANDOLPH (1978). *Géotechnique* **28**, No. 4, 435–464

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The estimate of the uplift pressures due to abnormal tides is based on the river conditions in existence when piezometer readings were made. The layer of silt on the river bed required to explain the actual responses of the piezometers to tide levels could be quite thin. Dredging of the river could have a marked effect on the piezometer response by removing or greatly reducing the thickness of the silt layer. Would it not therefore have been wise, for design purposes, to assume that the silt layer had been removed when estimating the maximum uplift pressures that might occur as a result of exceptional tides in the river?

Authors' reply

Higher pore water pressures could indeed occur if extensive dredging removed low permeability soil from the gravel outcrop in the river. However, the 'layer of low permeability' used in the analysis is a mathematical concept and does

not necessarily represent a single layer of silt on the river bed which can readily be removed by the strong tidal currents. This layer is much more likely to be equivalent to less permeable zones 'mixed' in the gravel during changes in the location of the river channel. At this site the maximum predicted piezometric pressure in the gravel (4.45 m ODN) used in the stability analyses is already approaching the value for a river level maintained at 6.4 m ODN. This is due to the high piezometric response and the assumption of a 12 h surge. Further increases in the uplift pressures in the gravel would also be limited by the flotation of the marsh. As a result of these factors and the reduced likelihood of future deep dredging, as a consequence of the reduced tonnage and size of ships using this part of the river, it was not considered necessary to make an additional allowance for dredging in this case. However, at locations where the piezometric response during normal tides is smaller than removal of impervious layers from the riverward side could be critical.

The conditions for failure of a face-centred cubic array of uniform rigid spheres

C. THORNTON (1979). *Géotechnique* **29**, No. 4, 441–459

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The Author has set out to generalize a solution for the strength of a packed sphere assembly, which I obtained previously, with a view to establishing whether any lower, and therefore more critical, solutions exist. Such a possibility was recognized by Rennie (1959), and also by me, at least in respect of the triaxial compression condition, where it was found that the optimum solution gave $\varepsilon_2 = \varepsilon_3$ at a value of σ_2 slightly above σ_3 . However, although the object is worthy, the task is by no means simple, and indeed some aspects of the analysis of friction force fields are virtually intractable.

That problems exist in the Author's analysis is suggested by results that conflict with basic physical experience. For example, when the Author allows his stress to rotate about the ε_3 (or

x) axis (his Fig. 9) under triaxial stress conditions, the failure strength decreases from the triaxial compression value as the distortion factor (or transverse restraint) increases, and is only partially recovered at the plane strain condition. To me, this is more than 'somewhat unusual'. Equally, in the case of three degrees of rotational freedom (his Fig. 11), it is indeed an 'unexpected phenomenon' that there should be no increment of σ_2 following the introduction of a stiff lateral restraint.

The analysis used to derive these solutions follows mine as far as equation (7). The Author then introduces variable shear stresses (or deviation angles) into equation (8), and uses these to obtain a more general solution to the eigenvalue problem. However, this procedure is not admissible because the chosen strain tensor already imposes particular relationships on the