APPENDIX A

Determination of Volumetric Oil Content

The determination of volumetric oil content discussed in section 3.7.2 was based on following important considerations:

- The amount of oil for each mixture was calculated as the percentage of dry mass of sand.
- The bulk density of the sample was calculated as the mass of the sand and oil combined divided by the total volume of the sample.

Volumetric oil content can be defined as the volume of the oil with respect to the total volume of the specimen expressed in percentage.

Now, the parameters which are known are:

Maximum dry density = $\gamma_{d,max}$ (Obtained from Proctor Compaction Test)

Optimum Moisture Content = w_o (Obtained from Proctor Compaction Test)

Apparent Specific Gravity = G_s (Obtained from Pycnometer Test)

Porosity corresponding to minimum dry density = η_{max} (minimum dry density obtained from sand replacement method).

Bulk density of the sand-oil mixture is,

$$(\gamma_{bulk}) = \gamma_{d,max} (1+ w_o) \quad (A.1)$$

Porosity corresponding to bulk density denoted as η_{min} is given as,

$$\eta_{min} = 1- (\gamma_{bulk}/G_s) \quad \text{(A.2)}$$

Let the total volume of the sample be V_0. Therefore, total pore volume at the given bulk density, V_P, is

$$V_p = n_{min} * V_0 \quad \text{(A.3)}$$

Let $\beta = \frac{1-\eta_{min}}{\eta_{max}-\eta_{min}}$ (A.4)

Porosity at 50% relative density, $\eta_{50\%} = \frac{0.5-(\eta_{max})\beta}{0.5-\beta}$ (A.5)

Pore Volume at 50% relative density, $V_{P,50\%} = \eta_{50\%} x 1000$ (A.6)

Soil Volume, $V_s = 1000 - V_{P,50\%}$ (A.7)

Weight of Soil Solids, $W_s = G_s \times V_s$ (A.8)

Oil Volume, $V_0 = \frac{\omega}{100} \times W_s$ (A.9)

Volumetric Oil Content = $\frac{V_O}{V_{P,50\%}}$ (A.10)

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