

# GEOTECHNICAL AND FOUNDATION FORMULA SHEET

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**IDENTIFICATION AND CLASSIFICATION OF SOIL AND ROCK**

1. The Coefficient of uniformity,  $C_u = D_{60}/D_{10}$   
 13. WATER CONTENT,  $w = W_w / W_s$   
 14. BULK DENSITY,  $\gamma = W/V = G_s (1+w) \gamma_w / (1 + e)$   
 $= (G_s + S_r e) \gamma_w / (1 + e)$

**HYDRAULIC PROPERTIES OF SOIL AND ROCK**

29. DISCHARGE VELOCITY,  $q = VA = kiA$ , discharge,  
 $v = ki$  ;  $k =$  Coefficient of permeability  
 $i = \Delta h/L$  head loss over length of flow path  
 $V = ki = q/A = q/Ta = Q/At$ ,

**Confined Aquifer**

40. Partially Penetrating  
 Coefficient of Permeability,  
 $k = [2.303 q \text{Log}_{10}(r_1/r_2)] / 2\pi D(h_1/h_2)G$ ,  
 $G = W/D [(1 + 7 \sqrt{(r_w/2W)} \cos(\pi W/2D))]$   
 $W =$  Partially Penetrating depth  
 $r_w =$  Radius of the well

**EFFECTIVE STRESS AND SEEPAGE PRESSURE**

**No flow condition,**

42. Total vertical pressure,  $p = H_0 \gamma_w + z \gamma_{sat}$   
 43. Pore water pressure,  $u_w = H_0 \gamma_w + z \gamma_w$   
 44. Effective vertical pressure,  $\sigma' = p - u_w = z(\gamma_{sat} - \gamma_w) = z\gamma'$   
 $z =$  certain depth of the soil

60. Settlement,  $S = C_c H [\log(p_0 + \Delta p) / p_0] / (1 + e_0)$ ,  
 For  $p_0 = p_c$ , normal consolidated clay  
 $p_0 =$  Effective overburden pressure  
 $p_c =$  Preconsolidation pressure

**SHALLOW FOUNDATION FOOTING AND RAFT**

87. Ultimate Bearing Capacity,  
 $q_d = cN_c + \gamma D_f N_q + 0.5\gamma B N_\gamma$  For Continuous footing  
 $C =$  Cohesion  
 $\gamma =$  Unit wt. Of soil  
 $D_f =$  Depth of foundation  
 $B =$  Width of foundation  
 $N_\gamma, N_c, N_q =$  Bearing capacity factor
113. Retaining wall Factor of Safety,  $F.S = (d \ 2t \ \tan \ \phi) / (\sigma'_h / \sigma'_v)A$ ,  $k = \sigma'_h / \sigma'_v$   
 $A =$  Area of surface of the wall,  
 $t =$  thickness of wall,  
 $d =$  required cantilever or penetration depth of the wall