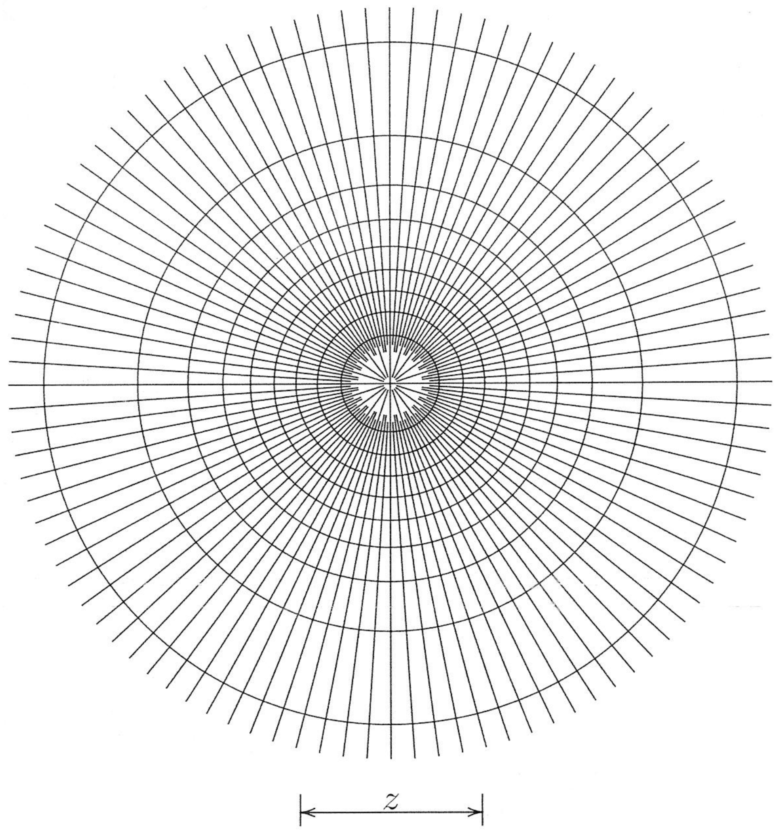
Formuleblad Grondmechanica



Korrels: $n=\frac{V_p}{V_g}$; $e=\frac{V_p}{V_k}$; $S=\frac{V_w}{V_p}$; $w=\frac{W_w}{W_k}$; $RD=\frac{e_{max}-e}{e_{max}-e_{min}}$; $w=Se\frac{\rho_w}{\rho_k}$;

Spanning: $\sigma_{xx}=\sigma'_{xx}+p$; $\sigma_{xy}=\sigma'_{xy}$; $\sigma_0=\frac{1}{3}\left(\sigma'_{xx}+\sigma'_{yy}+\sigma'_{zz}\right)$

Stroming: $q_x=-k\,i_x$; $q_x=\frac{Q_x}{A_x}$; $i_x=\frac{\partial h}{\partial x}$; $h=z+\frac{p}{\gamma_w}$; $k=\frac{\kappa\,\gamma_w}{\mu}$; $\kappa=cd^2\frac{n^3}{(1-n)^2}$; $i_{kr}=\frac{\gamma_n-\gamma_w}{\gamma_w}$

Falling Head Test: $h=h_0\exp\left(-\frac{k}{a}\frac{At}{L}\right)$; (of $k=c_v\gamma_w m_v$ voor: $\beta\to\infty$);

Put in confined aquifer: $h_0-h=-\frac{Q}{2\pi kD}\ln(\frac{r}{R})$; $\frac{\Delta\Phi}{\Delta s}=\frac{\Delta\Psi}{\Delta n}(\Phi=kh)$

Put in unconfined aquifer: $h_0^2-h^2=-\frac{Q}{\pi k}\ln(\frac{r}{R})$; $Q=\frac{n_{stroombaan}}{n_{potentiaalbaan}}k\Delta hB$

Continuüm: $\sigma_0=K\varepsilon_{vol}$; $\tau_{xy}=2G\varepsilon_{xy}$; $\varepsilon_{xx}=\frac{1}{E}\left[\sigma'_{xx}-\nu\left(\sigma'_{yy}+\sigma'_{zz}\right)\right]$; $\frac{\sigma'_v}{\varepsilon_v}=E_{oed}=\frac{1}{m_v}=K+\frac{4}{3}G=\frac{E(1-\nu)}{(1+\nu)(1-2\nu)}$;

$K=\frac{E}{3(1-2\nu)}$; $G=\frac{E}{2(1+\nu)}$;

Koppejan: $\varepsilon=U\left[\frac{1}{C_p}+\frac{1}{C_s}\log(\frac{t}{t_1})\right]\ln\frac{\sigma'}{\sigma'_1}$;

Bjerrum: $-\Delta e=e_1-e=C_r\log(\frac{\sigma_{grens}}{\sigma_1})+C_c\log(\frac{\sigma}{\sigma_{grens}})+C_\alpha\log(\frac{t}{t_1})$; $\varepsilon=\frac{1}{C_{10}}\log(\frac{\sigma}{\sigma_1})$ $(\sigma>\sigma_1)$; $\varepsilon=\frac{1}{A_{10}}\log(\frac{\sigma}{\sigma_1})$ $(\sigma<\sigma_1)$;

ISO: $-\Delta e=C_c\log(\frac{\sigma}{\sigma_1})$; $\varepsilon=\frac{-\Delta e}{1+e}$; $U=\frac{\Delta h-\Delta h_0}{\Delta h_\infty-\Delta h_0}=1-\frac{8}{\pi^2}\sum_{j=1}^{\infty}\frac{1}{(2j-1)^2}\exp[-(2j-1)^2\frac{\pi^2c_vt}{4h^2}]$; $U\approx\frac{2}{\sqrt{\pi}}\sqrt{\frac{c_vt}{h^2}}$ als $U<0.7$; $U\approx1-\frac{8}{\pi^2}\exp\left(-\frac{\pi^2}{4}\cdot\frac{c_vt}{h^2}\right)$ als $U>0.5$

Consolidatie: $\frac{\partial p}{\partial t}=c_v\frac{\partial^2 p}{\partial t^2}$; $c_v=\frac{k}{\gamma_w(m_v+n\beta)}$; $\frac{c_vt}{h^2}>>0.1$: $\frac{p}{p_0}=\frac{4}{\pi}\cos[\frac{\pi}{2}(\frac{h-z}{h})]\exp(-\frac{\pi^2}{4}\frac{c_vt}{h^2})$; $\frac{c_vt_{99\%}}{h^2}=1.784$;

$\frac{c_vt_{90\%}}{h^2}=0.848$; $\frac{c_vt_{50\%}}{h^2}=0.197$; $\frac{c_vt_{1\%}}{h^2}=10^{-4}\frac{\pi}{4}$; $p_i(1+\Delta t)=p_i(t)+\alpha[p_{i+1}(t)-2p_i(t)+p_{i-1}(t)]$; $\alpha=\frac{c_v\Delta t}{(\Delta z)^2}$;

Mohr-Coulomb: $(\frac{\sigma'_1-\sigma'_3}{2})-(\frac{\sigma'_1+\sigma'_3}{2})\sin\phi-c\cos\phi=0$; $\sin\phi=\frac{\frac{1}{2}(\sigma'_1-\sigma'_3)}{c\cdot\cot\phi+\frac{1}{2}(\sigma'_1+\sigma'_3)}$; $\sigma'_1=\sigma'_3\frac{1+\sin\phi}{1-\sin\phi}+2c\frac{\cos\phi}{1-\sin\phi}$;

Ongedraineerde sterkte: $c_u=s_u\approx\frac{\sigma'_1-\sigma'_3}{2}=\frac{c\cos\phi+\sigma'_0\sin\phi}{1-\frac{1}{3}\sin\phi}$; Coulomb: $\tau_f=c+\sigma'_n\tan\delta$;

Skempton / Henkel: $\Delta p=B[\Delta\sigma_3+A(\Delta\sigma_1-\Delta\sigma_3)]$; $B=\frac{1}{1+n\beta K}$; Triaxiaal: $A\approx\frac{1}{3}$ dilatant: $A<\frac{1}{3}$ contractant $A>\frac{1}{3}$;

Boussinesq: Punt: $r=0$: $\sigma_{zz}=\frac{3}{2}\frac{P}{\pi z^2}$; Starre plaat: $z=0$: $\frac{\sigma_{zz}}{p}=\frac{1}{2\sqrt{1-(r/a)^2}}$; $z=0$: $u_z=\frac{\pi}{2}(1-\nu^2)\frac{\bar{p}a}{E}=\frac{\pi}{4}(1-\nu)\frac{\bar{p}a}{G}$;

Flexibele plaat: $r=0$: $\frac{\sigma_{zz}}{p}=1-\frac{z^3}{\left(\sqrt{a^2+z^2}\right)^3}$; $u_z=2(1-\nu)^2\frac{pa}{E}=(1-\nu)\frac{pa}{G}$; Laagdikte factor: $f\approx1+\frac{h}{2a}-\frac{1+\frac{1}{2}(h/a)^2}{\sqrt{1+(h/a)^2}}$;

Flamant: Lijnlast ($r=\sqrt{x^2+z^2}$): $\sigma_{zz}=\frac{2Fz^3}{\pi r^4}$; $\sigma_{xx}=\frac{2Fx^2z}{\pi r^4}$; $\sigma_{xz}=\frac{2Fxz^2}{\pi r^4}$; Naast gladde wand: $x=0$: $Q_h=\frac{2}{\pi}\frac{F}{1+(a/h)^2}$ Strip: $x=0$: $\sigma_{zz}=\frac{2P}{\pi}[\arctan(\frac{a}{z})+\frac{az}{a^2+z^2}]$; $\sigma_{xx}=\frac{2P}{\pi}[\arctan(\frac{a}{z})-\frac{az}{a^2+z^2}]$;

Naast gladde wand: $Q_h=\frac{2}{\pi}ph\arctan(\frac{a}{h})$;

Horizontaaldruk: $K_e=\frac{\nu}{1-\nu}$; $K_0\approx1-\sin\phi$; $K_a=\frac{1-\sin\phi}{1+\sin\phi}$; $K_p=\frac{1+\sin\phi}{1-\sin\phi}$; $\sigma'_{h-min}=K_a\sigma'_v-2c\sqrt{K_a}$; $\sigma'_{h-max}=K_p\sigma'_v+2c\sqrt{K_p}$; $Q=\frac{1}{2}K\gamma h^2$; $Q_h=Q\sin(\alpha-\delta)$

Strookfundering: Prandtl: $(\varphi=0)$: $p_c=(\pi+2)c$; Brinch Hansen: $p_c=cN_ci_cs_c+qN_qi_qs_q+\frac{1}{2}\gamma BN_\gamma i_\gamma s_\gamma$; $N_q=\frac{1+\sin\phi}{1-\sin\phi}\exp(\pi\tan\phi)$; $N_c=(N_q-1)\cot\phi$; $N_\gamma=2(N_q-1)\tan\phi$;

$i_c=1-\frac{t}{c+p\tan\phi}$; $i_q=i_c^2$; $i_\gamma=i_c^3$; $s_c=1+0.2\frac{B}{L}$; $s_q=1+\frac{B}{L}\sin\phi$; $s_\gamma=1-0.3\frac{B}{L}$ $(L\ge B)$

Oneindig talud: $(c=0)$: $F\approx\frac{\tan\phi}{\tan\alpha}$; Stroming evenwijdig oppervlak: $F\approx\frac{\gamma_n-\gamma_w}{\gamma_n}\frac{\tan\phi}{\tan\alpha}$; Horizontale stroming: $F\approx\frac{\gamma_n-(\gamma_w/\cos^2\alpha)}{\gamma_n}\frac{\tan\phi}{\tan\alpha}$

Eindig talud: Fellenius: $F\approx\frac{\sum[(c+(\gamma h\cos^2\alpha-p)\tan\phi)/\cos\alpha]}{\sum\gamma h\sin\alpha}$; Bishop: $F\approx\frac{\sum\frac{c+(\gamma h-p)\tan\phi}{\cos\alpha(1+\tan\alpha\tan\phi/F)}}{\sum\gamma h\sin\alpha}$