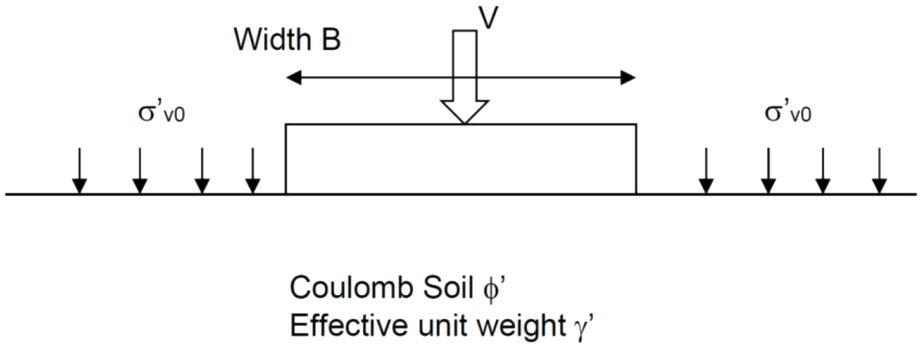
Assignment 7b: Bearing capacity of drained sands



The bearing capacity of drained sand is defined as:

$$q_f = V/B = 0.5N_\gamma \gamma' B + N_q \sigma'_{v0}$$

$0.5N_\gamma \gamma' B$ is the resistance due to confinement of the soil. $N_q \sigma'_{v0}$ is the resistance due to the surcharge.

However, the bearing capacity evaluated using the above equation is incorrect. Using the specific example shown below, prove that the classical superposition solution of resistance due to confinement of the soil + resistance due to surcharge is conservative. To solve the bearing capacity equation, you may want to use the Analysis of Bearing Capacity software `http://www2.eng.ox.ac.uk/civil/people/cmm/software`. Unfortunately this only works on Windows, please let me know if you have any issues.

A 5 m wide rough strip footing on Coulomb dry soil with a density of $20kN/m^3$, friction angle LaTeX: $\phi = 30\,\text{deg}$, and a surcharge of $10kN/m^2$. Evaluate the following:

Additional reading material: Determination of bearing capacity of shallow foundations without using superposition approximation.

1. Bearing capacity purely due to the confinement of the soil (kPa):
2. Bearing capacity purely due to surcharge (ignore resistance due to soil confinement) in kPa:
3. Bearing capacity of drained sand (combined effect based on the above equation) in kPa:
4. Numerical solution using the Analysis of Bearing Capacity (software) for the combined effect of self-weight and surcharge in (kPa):
5. Discuss your results and explain why a difference is observed between the bearing capacity equation and the numerical solution?