

Calculation for concrete needed to keep a 3600L septic tank from floating at 30 Mackenzie Road.

Assumptions:

3600 L septic tank is a concrete from A & B Precast

Safety factor is 1.5

Tank is buried 0.15m below grade

$$V_c = \frac{(SF \cdot F_B - F_T - F_s)}{Y_c}$$

Where

V_c = volume of concrete

F_B = the buoyant force of the groundwater pushing up (kN)

F_T = the weight of the tank (kN)

F_s = the weight of the soil (kN)

SF = factor of safety 1.5 – 2.0

Y_c = submerged specific weight of concrete (14kN/m³ typically)

$$\begin{aligned} F_B &= \text{volume of tank submerged (m}^3\text{) x specific weight of water (kN/m}^3\text{)} \\ &= 2.286 * 1.524 * 1.651 * 9.81 \\ &= 56.42\text{kN} \end{aligned}$$

$$\begin{aligned} F_T &= \text{mass of tank (kg) * gravity (m/s}^2\text{) / 1000} \\ &= 3640 * 9.81 / 1000 \\ &= 35.7\text{kN} \end{aligned}$$

$$\begin{aligned} F_s &= \text{volume of soil above tank (m}^3\text{) * specific weight of soil (kN/m}^3\text{)} \\ &= (2.286 * 1.524 * 0.15) * 19 \\ &= 9.9 \text{ kN} \end{aligned}$$

$$\begin{aligned} V_c &= (SF * F_B - F_T - F_s) / \text{Specific weight of concrete} \\ &= (1.5 * 56.42 - 35.7 - 9.9) / 14 \\ &= (39.03) / 14 \\ &= 2.78\text{m}^3 \end{aligned}$$

Formula taken from Ontario Rural Wastewater Centre: Advanced Design of On-site Wastewater Treatment Systems