



Structural calculation to check design compliance with CIRIA C680

Scheme Name 2601-a176 Land at Beckermet, Cumbria
Revision No.
Product RAINBOX 3S



Assumptions

Wet density of the backfill 20.0 kN/m²
Saturated density of the backfill 11.0 kN/m²
Angle of shearing resistance 35° (for native soil / backfill material)

Tank Position

Depth of tank is 1.68 m
Cover above tank is 0.75 m
Depth to base of tank is 2.43 m
Depth to groundwater is 0.00 m (Assumes no groundwater present)

Site use Cars parks, occasional light delivery vehicles
traffic = cars or light vans up to 6000 kg GVW

As per CIRIA C680 surcharges and partial safety factors are applied to all the loadings to obtain the design loads.

Vertical Loads

Dead Load = 15.0 kN/m²
Surcharge (distributed load) = 5.0 kN/m²
Apply PSF of 1.4 to fixed load and 1.6 to variable load to obtain Design Load
Design Dead Load = 21.0 kN/m²

Design Dead Load + Distributed Live Load = 29.0 kN/m²

Vertical Live Load

Wheel load is: 20.0 kN/m² (for cars or light vans up to 6000 kg GVW)
on an area of 0.20 m X 0.20 m
Area of load spread at 0.75 m depth = 0.9 m²
Therefore Wheel Load at this depth = 21.5 kN/m²
Apply PSF of 1.6 for Live Load and Design Live Load = 34.4 kN/m²
Total Design Vertical Load = 55.4 kN/m²

Worst case of Dead Load + Distributed Live Load or the Wheel Loading

55.4 kN/m²

This must be less than the ultimate short term compressive strength of the cell with a partial safety factor of 2.75 applied which = 72.4 kN/m²

Therefore this design loading complies with the requirements of CIRIA C680 for Vertical Loads



Lateral Loads at base of tank

Ka = Coefficient of shear resistance

Angle of shear resistance = 35°; Ka = 0.271

Dead Load (at 2.23 m) = 44.60 kN/m²

Surcharge (distributed load) = 5.0 kN/m²

Total = 49.6 kN/m²

Lateral Pressure (Unfactored) = 13.4 kN/m²

Hydrostatic pressure (at 2.23 m) = 0.0 kN/m²

Factored Design Lateral Pressure (PSF 1.35) = 18.1 kN/m²

This must be less than the ultimate short term compressive strength of the cell with a partial safety factor of 2.75 applied which = 42.5 kN/m²

Therefore this design loading complies with the requirements of CIRIA C680 for Lateral Loads

Servicability Limit State Checks (Deflection & Creep)

The servicability of the proposed product can be assessed by predicting possible unit deflection(short Term) and creep (long term).

Unit deflection

SLS (Serviceability Limit State) = 21.5 kN/m²

Design Strength = 20.95 kN/m²

Deflection mm = 1.0 mm

Vertical Creep

Creep Test load = 85.00 kN/m²

SLS (Serviceability Limit State) = 15.0 kN/m²

Degree of Utilisation = 18%

We are therefore happy to confirm that the cells used in this scheme will have a design life in excess of 50 years.

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