Polypipe
Civils & Green Urbanisation

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Polystorm Uplift / Buoyancy Check - Based on Eurocode 7

C2757 Norton Grange Farm, Aldingbourne - Floatation Calculations (GWL at GL)

Design factor of safety (FoS)

Ultimate Limit State		Uplift (UPL)	
Permanent actions (G)	- Stabilising, $\gamma_{G,stb}$	0.9	*[Table A.NA.15, NA to BS EN 1997-1:2004]*
	- Destabilising, $\gamma_{G,dst}$	1.1	*[Table A.NA.15, NA to BS EN 1997-1:2004]*
Variable actions (Q)	- Stabilising, $\gamma_{Q,stb}$	0	*[Table A.NA.15, NA to BS EN 1997-1:2004]*
	- Destabilising, $\gamma_{Q,dst}$	1.5	*[Table A.NA.15, NA to BS EN 1997-1:2004]*

Assumed installation parameters

Material density	- granular backfill, γ_{Bk}	20.0 kN/m³	*[Assumed]*
	- water, γ_{Wk}	9.81 kN/m³	*[Assumed]*
	- saturated backfill, γ'_{Bk} ($= \gamma_{Bk} - \gamma_{Wk}$)	10.2 kN/m³	
Depths	- GL to structure IL, H	1.450 m	
	- GL to GWL, h_w	0.000 m	

Proposed Polystorm structure

Unit description	Ignore
Product code	-
Structure depth, h_1	0.800 m
Cover depth, h_c	0.650 m

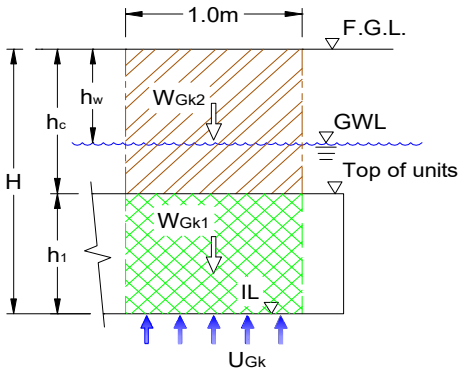


Fig 1) Definitions illustration

Actions

Displaced water volume, Vol_{cell} 0.80 m³/m²

Characteristic destabilising

Water uplift, U_{Gk} ($= \gamma_{wk} \times Vol_{cell}$) *7.85 kN/m²*

Characteristic stabilising

Self weight of

- Polystorm structure, W_{Gk1} *N/A*
- Backfill, W_{Gk2} *0.00 kN/m²*
  (If $h_w < h_c = \gamma_{Bk} \times h_w$; else $= \gamma_{Bk} \times h_c$)
- Saturated fill, W'_{Gk2} *6.62 kN/m²*
  ($= \gamma'_{Bk} \times [h_c - h_w]$)

Effects of Actions

Destabilising design vertical actions, $V_{d,dst}$ ($= \gamma_{G,dst} \times U_{Gk}$) ***8.63 kN/m²***

Stabilising design vertical actions, $V_{d,stb}$ ($= \gamma_{G,stb} \times W_{Gk}$) ***5.96 kN/m²***

Degree of utilization, Λ_{UPL} ($= V_{d,dst} / V_{d,stb}$) ***145 %*** ***> 100%; FAILS Check***

Traditional Verification of Stability Against Uplift

Traditional lumped FoS, F ($= W_{GK} / U_{GK}$) **0.8**

Notes

1. Groundwater assumed to act as a permanent destabilising action
2. If uncertainty in the level of ground or free water exists, consideration should be given to the application of a safety margin to the assumed characteristic water level
3. The above assessment assumes that the Polystorm structure is completely flexible and that there is negligible fricitional resistance between the geocellular structure and the native soil. The uplift stability verification has therefore been simplified, based on a m² (plan area) basis.

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