



ACE Geosynthetics

www.geoace.com

Wave-Load Design for ACEFormer™

ACE Geosynthetics

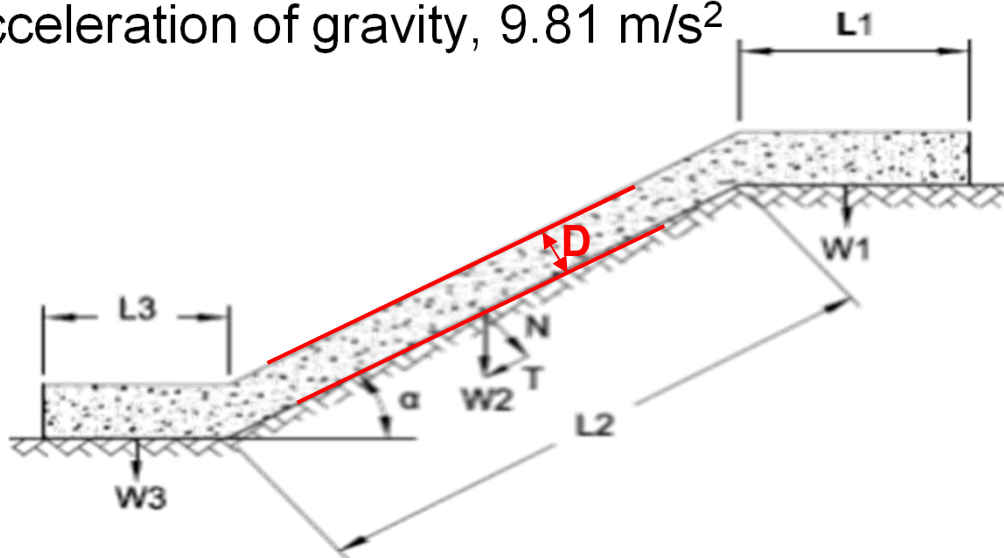
www.geoace.com

Outline

- **Thickness Design**
- **Toe Width Design**
- **Wave Splash Width Design**
- **Stability Analysis**

Thickness Design

- **D = thickness of filled ACEFormer (m)**
- H_s = significant wave high (m)
- Δ = relative density
- F = revetment stability factor, 4.0 for concrete mattress
- ξ_{op} = breaker parameter
- α = slope angle ($^\circ$)
- L_{op} = deep-water wavelength (m)
- T_p = Wave period at the peak of the spectrum (sec)
- g = acceleration of gravity, 9.81 m/s^2



$$\frac{H_s}{\Delta D} = \frac{F}{\xi_{op}^{0.67}} \leq 8$$

$$\Delta = \frac{\rho_s - \rho_w}{\rho_w}$$

$$\xi_{op} = \frac{\tan \alpha}{\sqrt{\frac{H_s}{L_{op}}}}$$

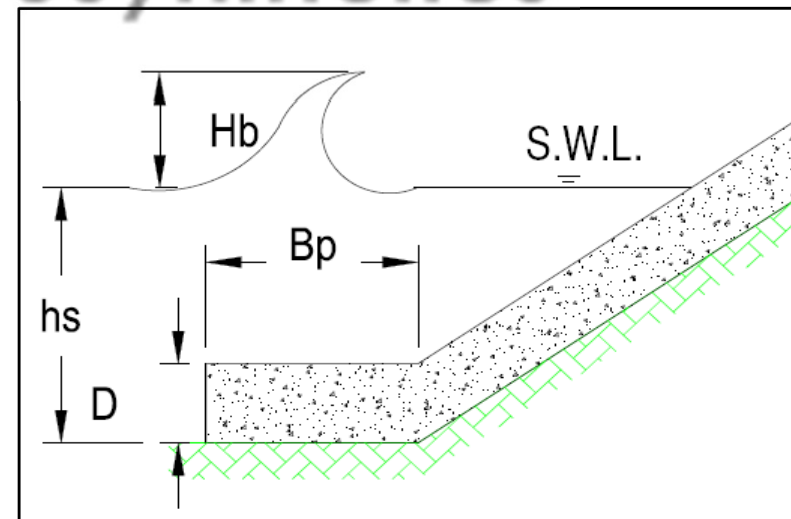
$$L_{op} = \frac{g T_p^2}{2\pi}$$



Toe Width Design

- B_p = width of the ACEFormer toe(m)
- H_b = breaker wave height (m)
- Δ = relative density
- D = thickness of filled ACEFormer (m)
- T = wave period (s)
- g = acceleration of gravity, 9.81 m/s^2
- h_s = shallow water depth (m)

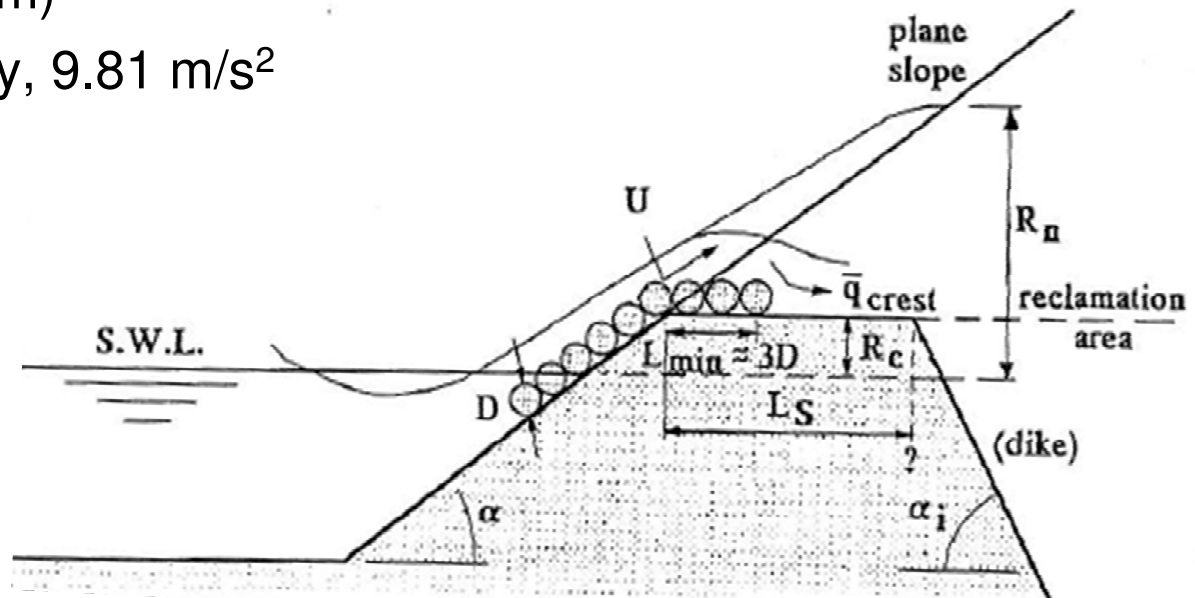
$$\frac{H_b}{\Delta D} = 20 \left(\frac{B_p}{T \sqrt{gh_s}} \right)^{2/3}$$



Wave Splash Width Design

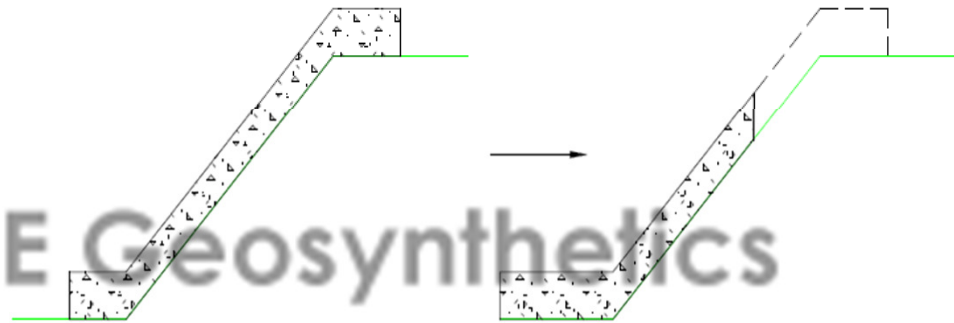
- L_s = width of splash(m)
- Ψ = engineer-judgement safety factor according to importance of structure), usually, $1 < \Psi < 2$.
- T = wave period (s)
- R_n = wave run-up (m)
- R_c = crest height above S.W.L.
- D = thickness of former (m)
- g = acceleration of gravity, 9.81 m/s^2

$$L_s = \frac{\Psi}{5} T \sqrt{g(R_n - R_c)} \geq 3D$$

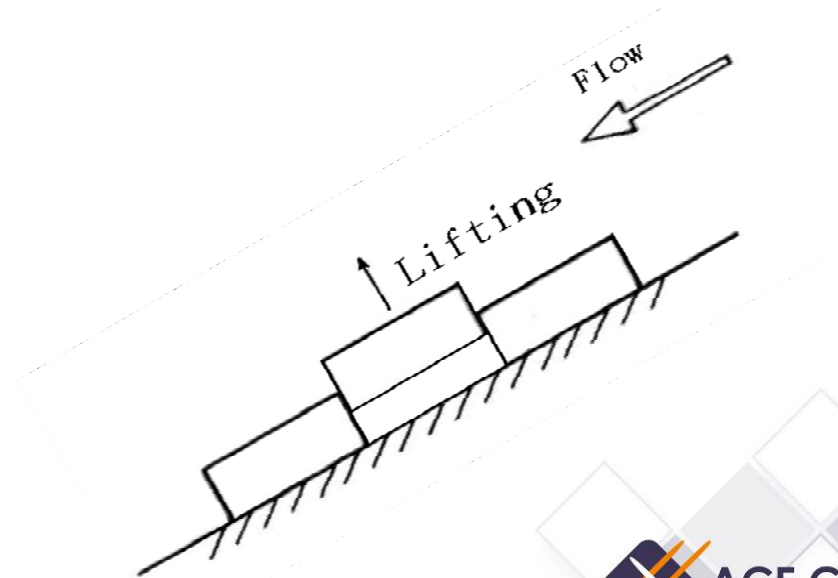


Stability Analysis -- Failure Type

- Sliding downward

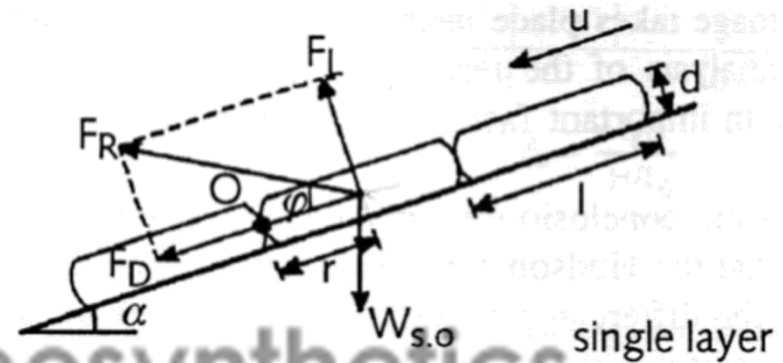


- Lifting



Stability Analysis -- Force System

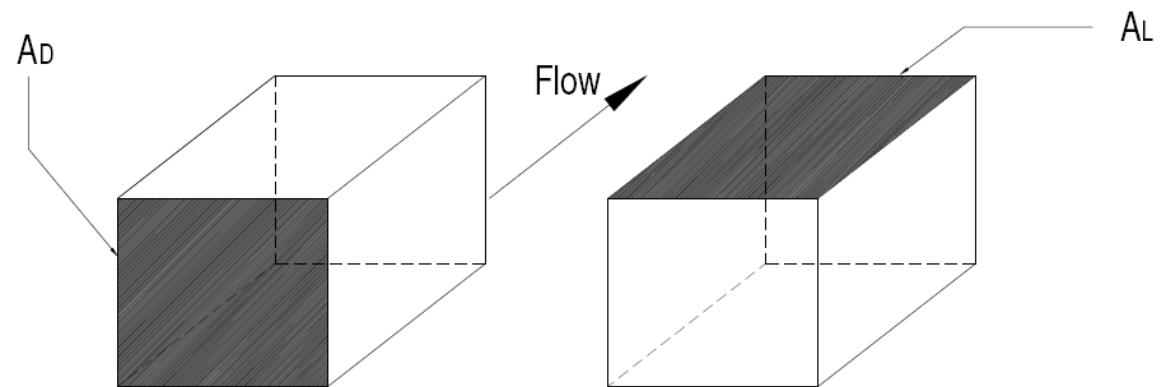
- F_D = Dragging force,
- F_L = Lifting force,
- C_D = Drag coefficient, $C_D=0.3$
- C_L = Lift coefficient, $C_L=0.5$
- A_D = Area to withstand dragging, 1m^2 for ACEFormer
- A_L = Area to withstand lifting, 1m^2 for ACEFormer



$$F_L = \frac{1}{2} C_L \rho_w u^2 A_L$$

$$F_D = \frac{1}{2} C_D \rho_w u^2 A_D$$

$$u = \phi \sqrt{2gH_s}$$



Stability Analysis – Safety Factors

- f_{cs} = friction coefficient, $f_{cs}=0.7$ for ACEFormer
- W = self weight of filled ACEFormer

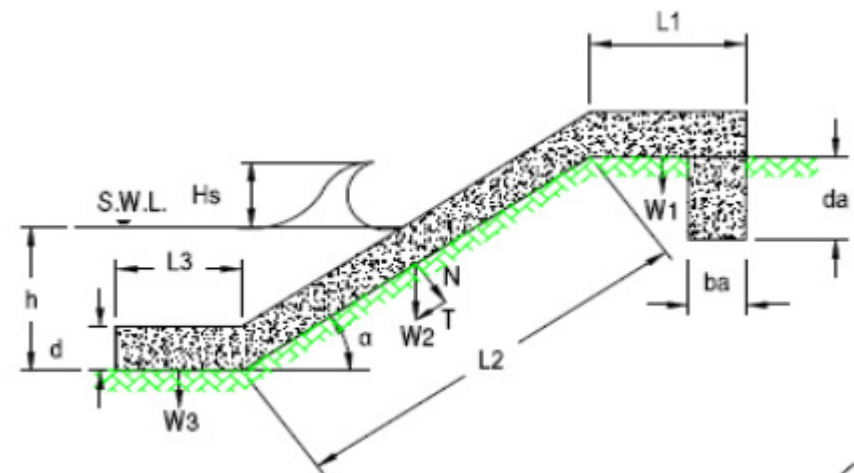
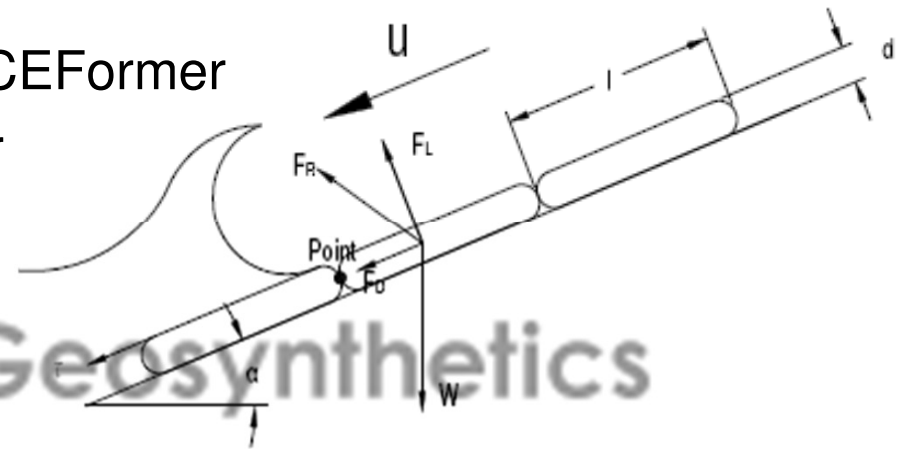
$$FS_{lifting} = \sum \frac{\text{resisting force}}{\text{lifting force}}$$

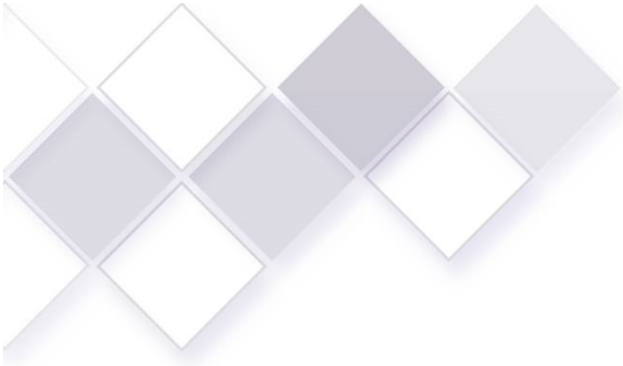
$$= \frac{W \cos \alpha}{F_L}$$

$$FS_{sliding} = \sum \frac{\text{resisting friction force}}{\text{sliding force}}$$

$$= \frac{(W_1 + (W_2 \cos \alpha - F_L) + W_3) f_{cs}}{W_2 \sin \alpha + F_D + \tau b d}$$

$$= \frac{(W_1 + (W_2 \cos \alpha - F_L) + W_3) f_{cs}}{W_2 \sin \alpha}$$





Reference

1. Pilarczyk, K., (2000), “Geosynthetics and Geosystems in Hydraulic and Coastal Engineering”, CRS Press, Ch.4.



ACE Geosynthetics

2. Young C. K., (2009), “Handbook of Coastal and Ocean Engineering”, World Scientific Pub Co Inc.



ACE Geosynthetics

Accurate, Collaborative, Efficient

No.33, Jing 3 Rd., C.E.P.Z. Wuchi District, Taichung City, Taiwan, R.O.C.

[http: //www.geoace.com](http://www.geoace.com) email: sales@geoace.com

Copyright © 2015 ACE Geosynthetics. All rights reserved