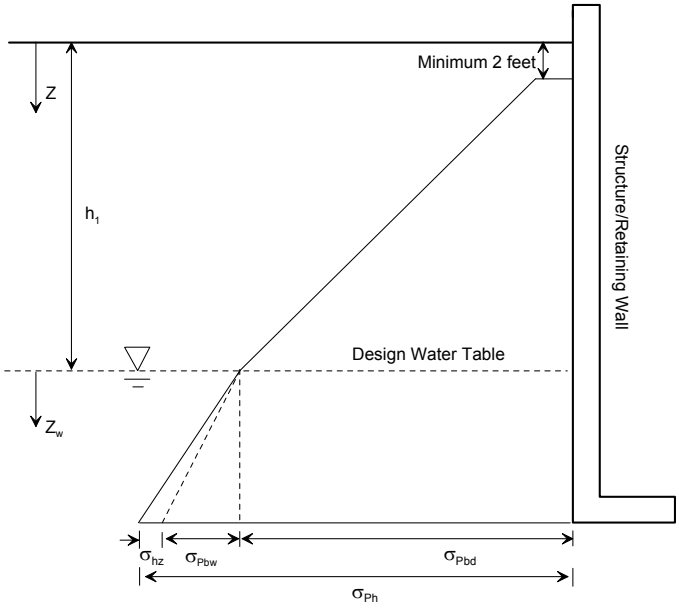
Passive Earth Pressure



$k_P = \tan^2(45 + \frac{\phi'}{2}) = 3.25\ [1.7]$	Passive earth pressure coefficient
$\sigma_{Pbd} = k_P \gamma_t Z \cong 406Z\ [213Z]$	Passive pressure above water table $(2 < Z \le h_1)$
$\sigma_{Pbd} = 0$	No passive pressure for $(Z \le 2)$
$\sigma_{Pbw} = k_P(\gamma_t - \gamma_w)Z_w \cong 203Z_w\,[103\,Z_w]$	Passive pressure increment below h_1 (water table depth)
$\sigma_{hz} = \gamma_w Z_w \cong 62.4Z_w$	Hydrostatic pressure
$\sigma_{Ph} = \sigma_{Ps} + \sigma_{Pbd} + \sigma_{Pbw}$	Total passive (horizontal) pressure

Notes:

- Units: psf for pressure and ft for dimensions.
- Assumed compacted backfill properties:
  - Total unit weight: γ_t =125 pcf
  - Internal effective friction angle: ϕ' = 32°
  - Effective cohesion intercept: C′ = 0
- Seismic earth pressure and compaction earth pressure not included.
- A horizontal displacement of about 0.02H at the top of the walls is required in order to mobilize the full passive resisting forces (H is total wall height). For the case of rigid and unyielding walls, the numbers are shown in brackets (ϕ' is limited to 15°).