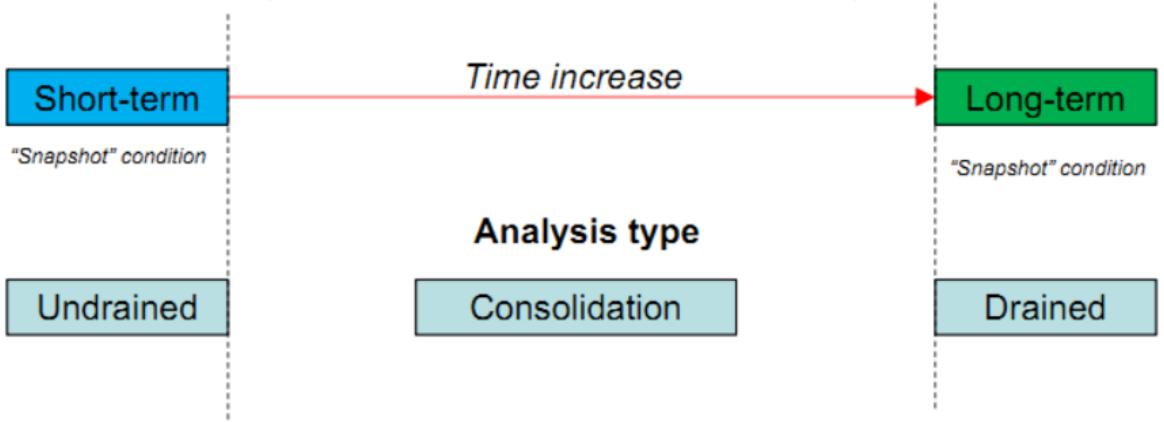
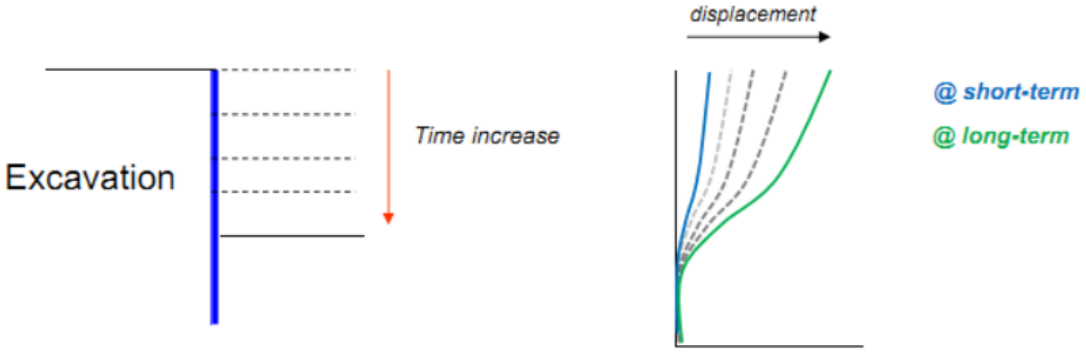
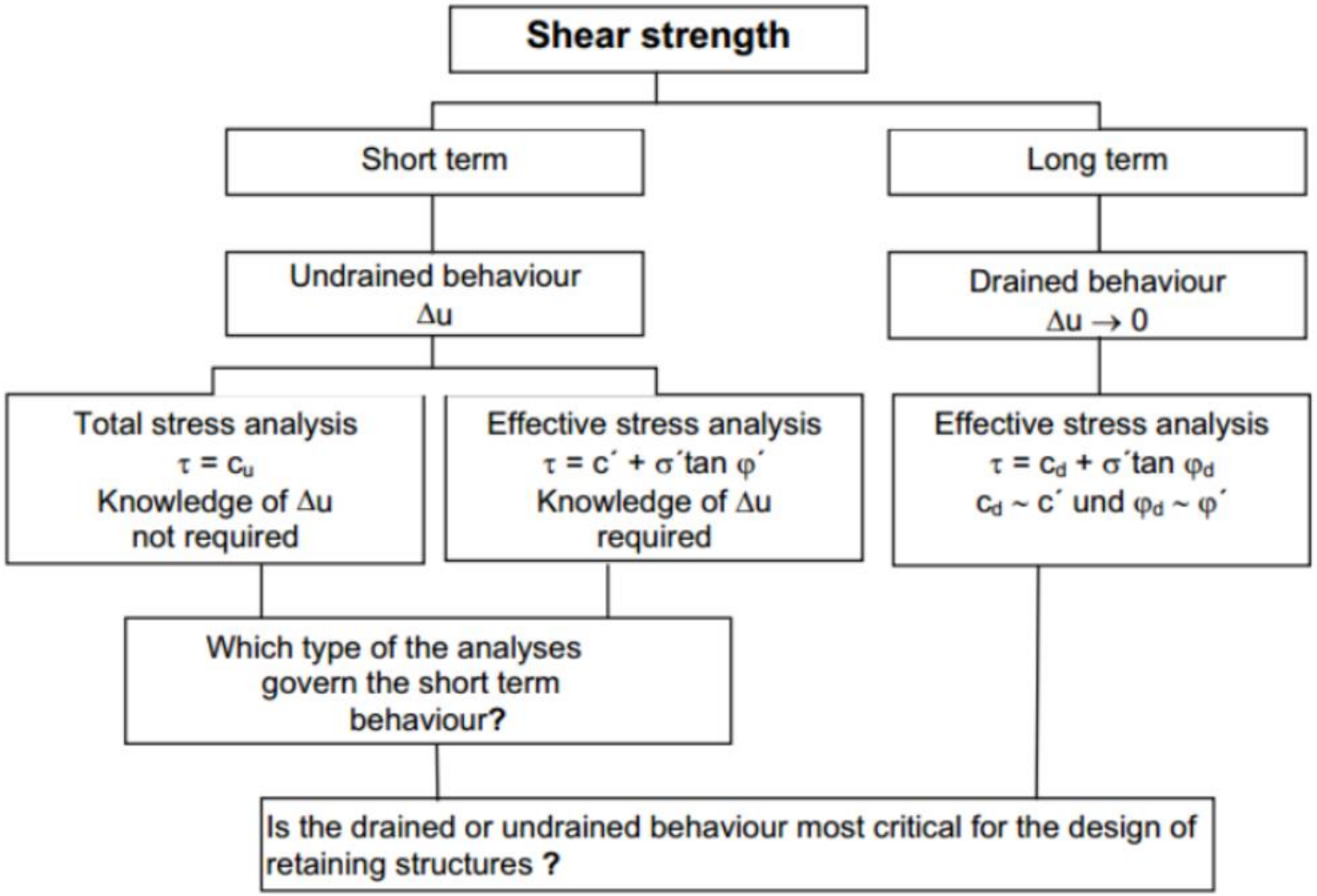
DRAIN & UNDRAIN TRONG PLAXIS

Construction progress & time
(Soil stresses and porewater pressure)






Shear strength
Short term
Long term
Undrained behaviour
Δu
Drained behaviour
Δu → 0
Total stress analysis
τ = cu
Knowledge of Δu
not required
Effective stress analysis
τ = c´ + σ´tan φ´
Knowledge of Δu
required
Effective stress analysis
τ = cd + σ´tan φd
cd ~ c´ und φd ~ φ´
Which type of the analyses
govern the short term
behaviour?
Is the drained or undrained behaviour most critical for the design of
retaining structures ?

Drained / undrained

- Drained analysis appropriate when
  - Permeability is high
  - Rate of loading is low
  - Short term behaviour is not of interest for problem considered

- Undrained analysis appropriate when
  - Permeability is low and rate of loading is high
  - Short term behaviour has to be assessed

Drained / undrained

Suggestion by Vermeer & Meier (1998) for deep excavations:

$T < 0.10$ $(U < 10\%)$ use undrained conditions

$T > 0.40$ $(U > 70\%)$ use drained conditions

$$T = \frac{k\,E_{oed}}{\gamma_w\,D^2}\,t$$

k	=	Permeability
E_{oed}	=	Oedometer modulus
γ_w	=	Unit weight of water
D	=	Drainage length
t	=	Construction time
T	=	Dimensionless time factor
U	=	Degree of consolidation

Undrained behaviour with PLAXIS

Method A (analysis in terms of *effective* stresses):
type of material behaviour: *undrained*
effective strength parameters c', φ', ψ'
effective stiffness parameters E_{50}', ν'

Method B (analysis in terms of *effective* stresses):
type of material behaviour: *undrained*
undrained strength parameters $c = c_u$, $\varphi = 0$, $\psi = 0$
effective stiffness parameters E_{50}', ν'

Method C (analysis in terms of *total* stresses):
type of material behaviour: *drained*
total strength parameters $c = c_u$, $\varphi = 0$, $\psi = 0$
undrained stiffness parameters E_u, $\nu_u = 0.495$

Undrained behaviour with PLAXIS

Notes on different methods:

- Method A:
  - Recommended
  - Soil behaviour is always governed by effective stresses
  - Increase of shear strength during consolidation included
  - Essential for exploiting features of advanced models such as the Hardening Soil model, the Soft Soil model and the Soft Soil Creep model
- Method B:
  - Only when no information on effective strength parameters is avilable
  - Cannot be used with the Soft Soil model and the Soft Soil Creep model
- Method C:
  - NOT recommended
  - No information on excess pore pressure distribution (total stress analysis)

Overview of models and allowable drainage types

Material model	Drainage type
Linear Elastic model	Drained Undrained (A) Undrained (C) Non-porous
Mohr-Coulomb model	Drained Undrained (A) Undrained (B) Undrained (C) Non-porous
Hardening Soil model	Drained Undrained (A) Undrained (B)