Welcome to this MSc course

Make the most of your Master's program

Take advantage of two things: first the gap between tutor and student narrows extremely compared to undergraduate studies and second knowledge gets more specialized; ***make the most of your time by asking questions***

Sharing specialized knowledge and ideas provides a more rounded knowledge of the entire subject. It is a very efficient way of working if you split up reading lists between you and then share your notes. ***Work with your course mates***

If you take just one thing away from this introduction let it be , Take full advantage of the opportunities and resources at your disposal, with respect to both taught material and people!

GEOTECHNICAL ENGINEERING IN THE DESIGN OF STRUCTURES

Professor V.N. Georgiannou, MSc,DIC,Ph.D.

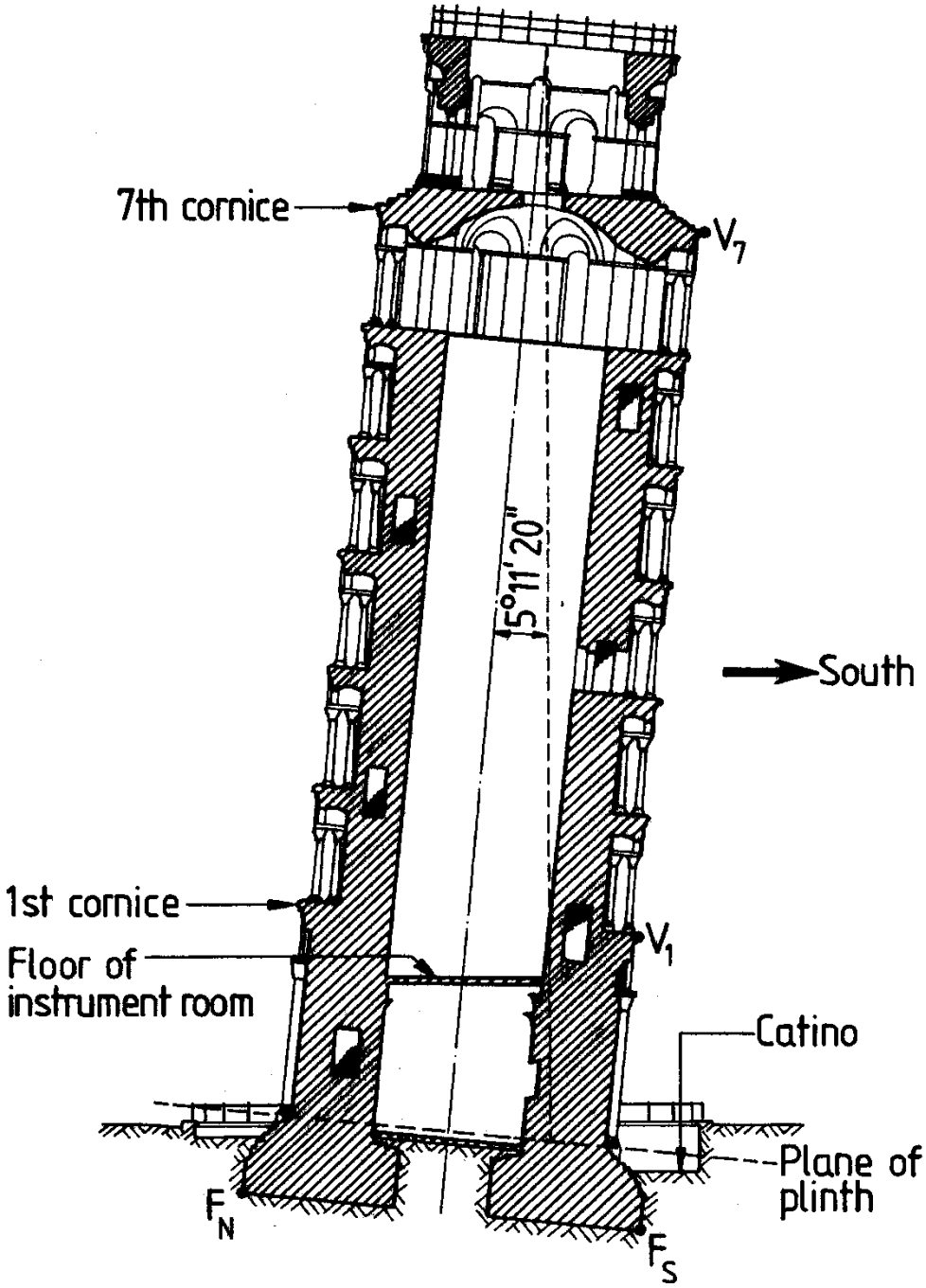
Αθήνα, 5/10/2023

CONTENTS

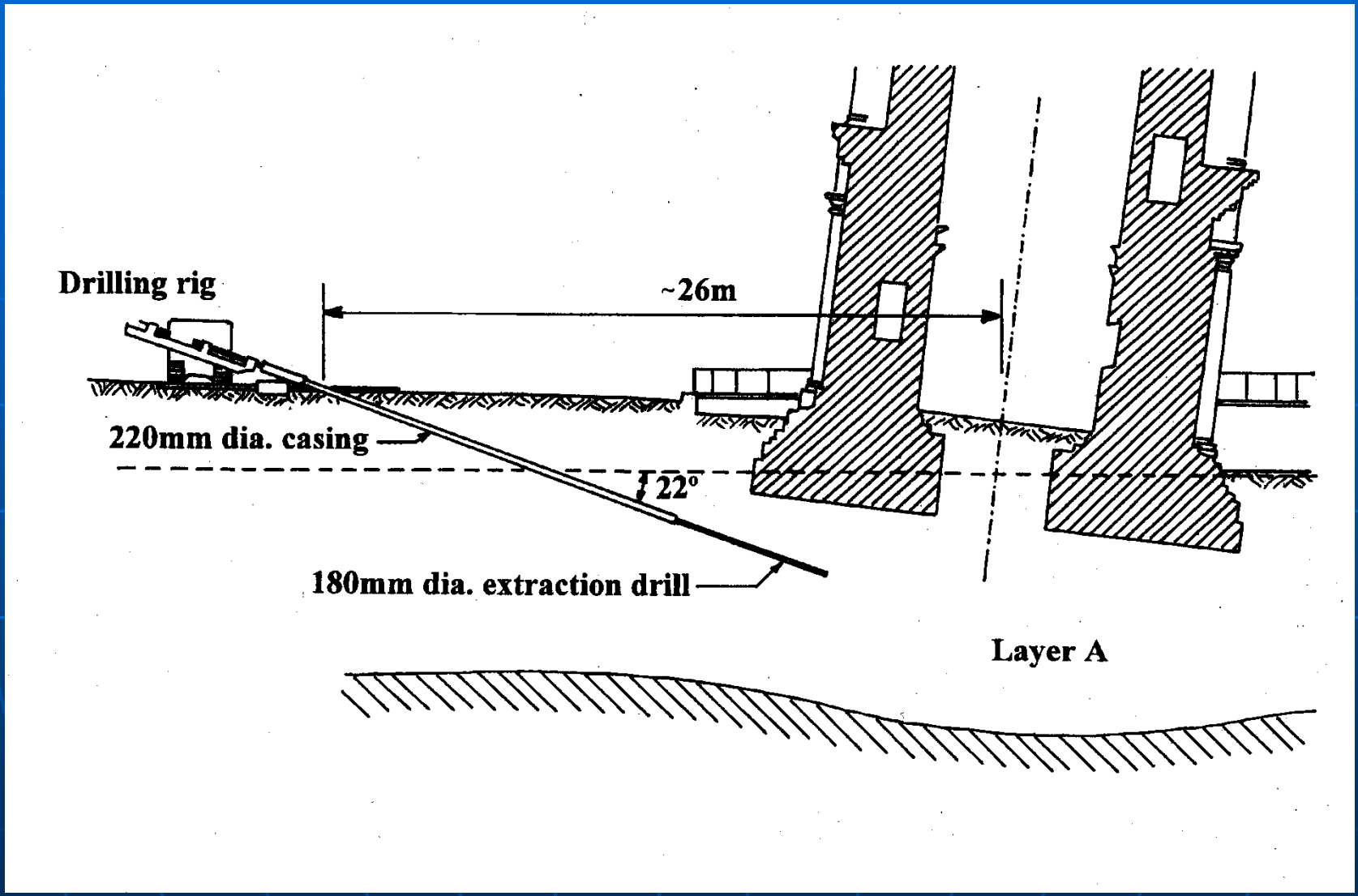
1. Determination of the main soil parameters that govern its engineering behaviour to be used in design:

- Parameters needed for consolidation settlement calculations (Es, cc, cs, cv) are determined via the consolidation test

- **1st PROJECT: PISA**

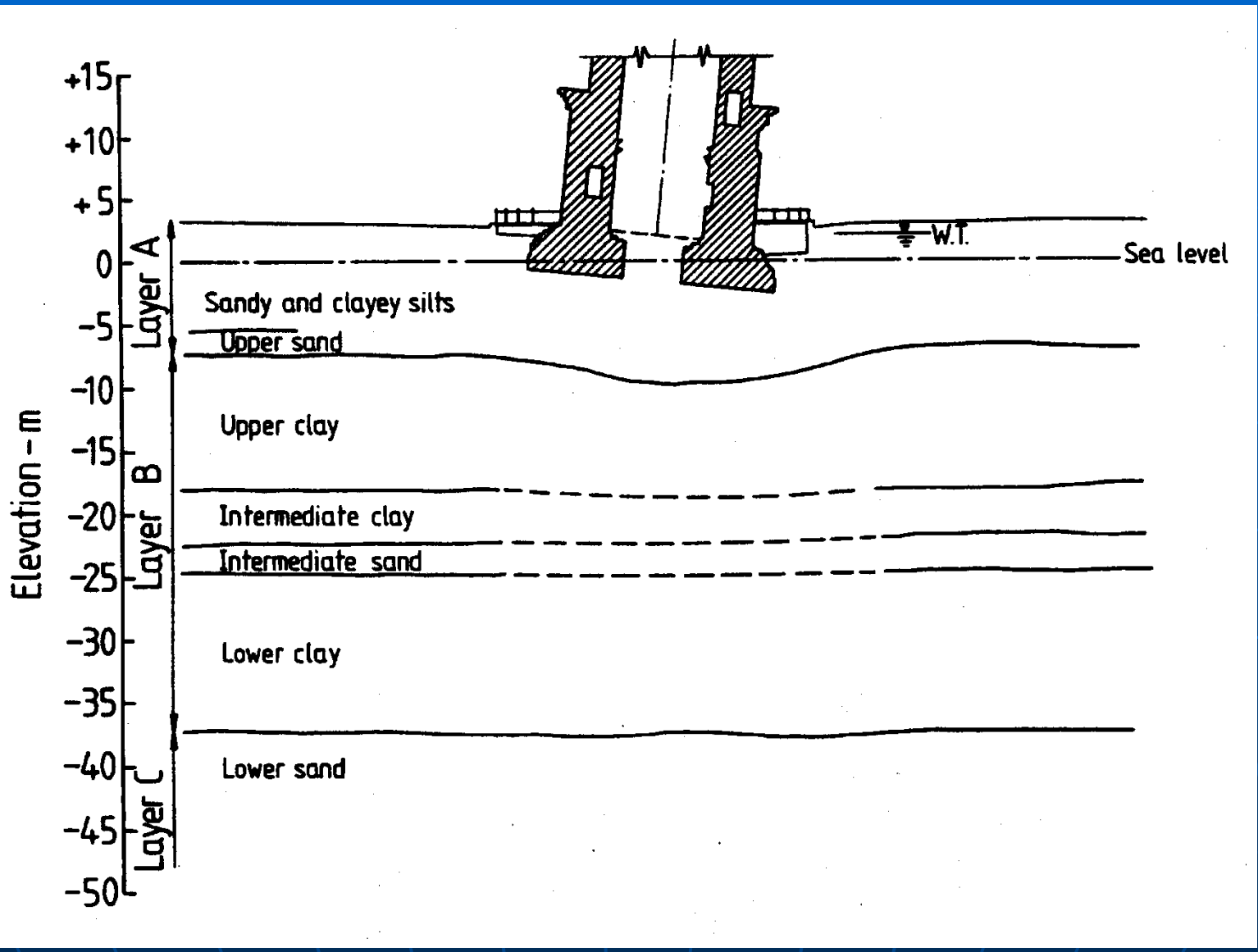

7th cornice
V_7
5°11'20"
South
1st cornice
Floor of instrument room
V_1
Catino
Plane of plinth
F_N
F_S

Stabilisation using underexcavation

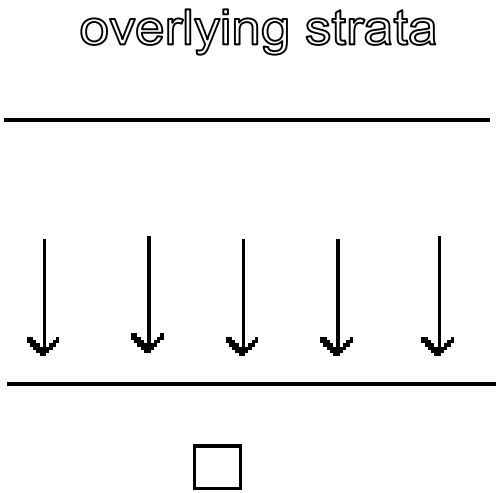


augers

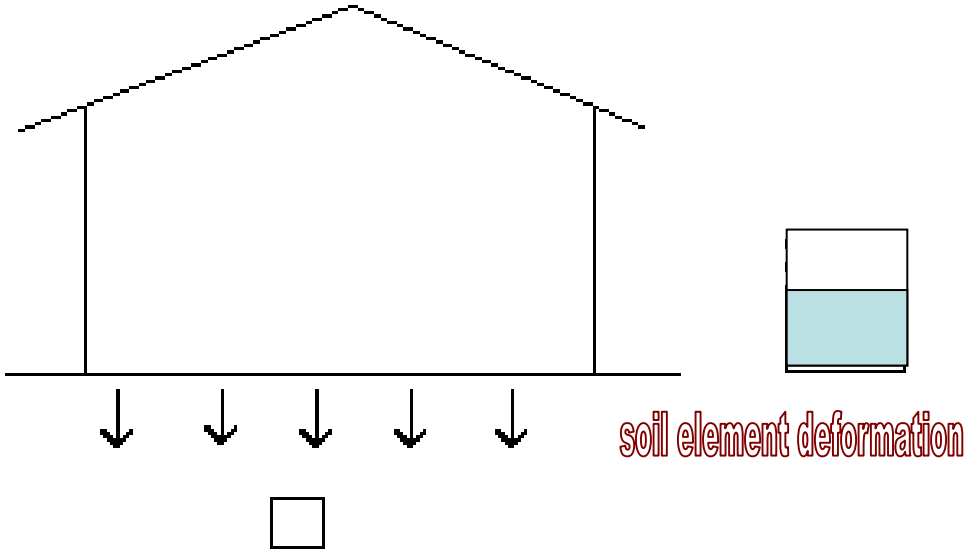

SOLIMEC


+15
+10
+5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Elevation - m
Layer A
Layer B
Layer C
W.T.
Sea level
Sandy and clayey silts
Upper sand
Upper clay
Intermediate clay
Intermediate sand
Lower clay
Lower sand

ΣΤΕΡΕΟΠΟΙΗΣΗ-CONSOLIDATION



Soil element



Condition:
extended foundation-->
symmetry in loading

CONTENTS

1. Determination of the main soil parameters that govern its engineering behaviour to be used in design:

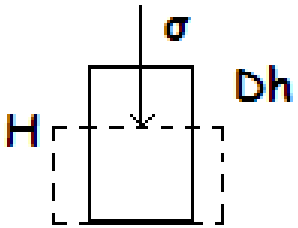
- Parameters needed for consolidation settlement calculations(Es, cc, cs, cv)

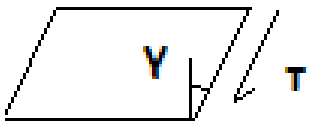
- Shear strength parameters (determination & choice)

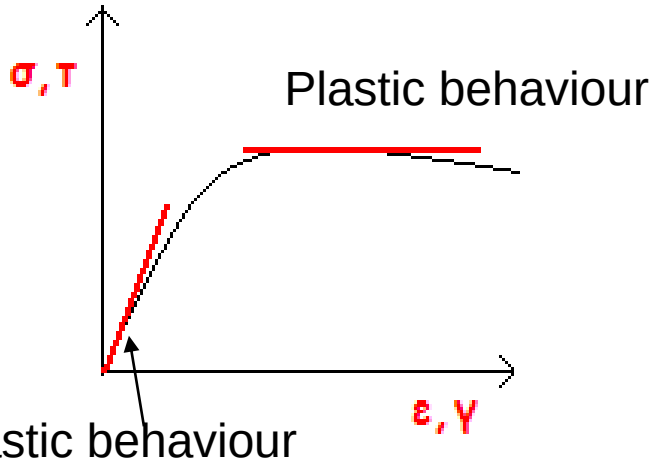
- Determination of soil stiffness to be used in numerical analyses.

Stress – strain relationship

- Isotropic linear elastic soil behaviour
- Plastic soil behaviour
- Elastic constants







$E=\sigma/\varepsilon,$

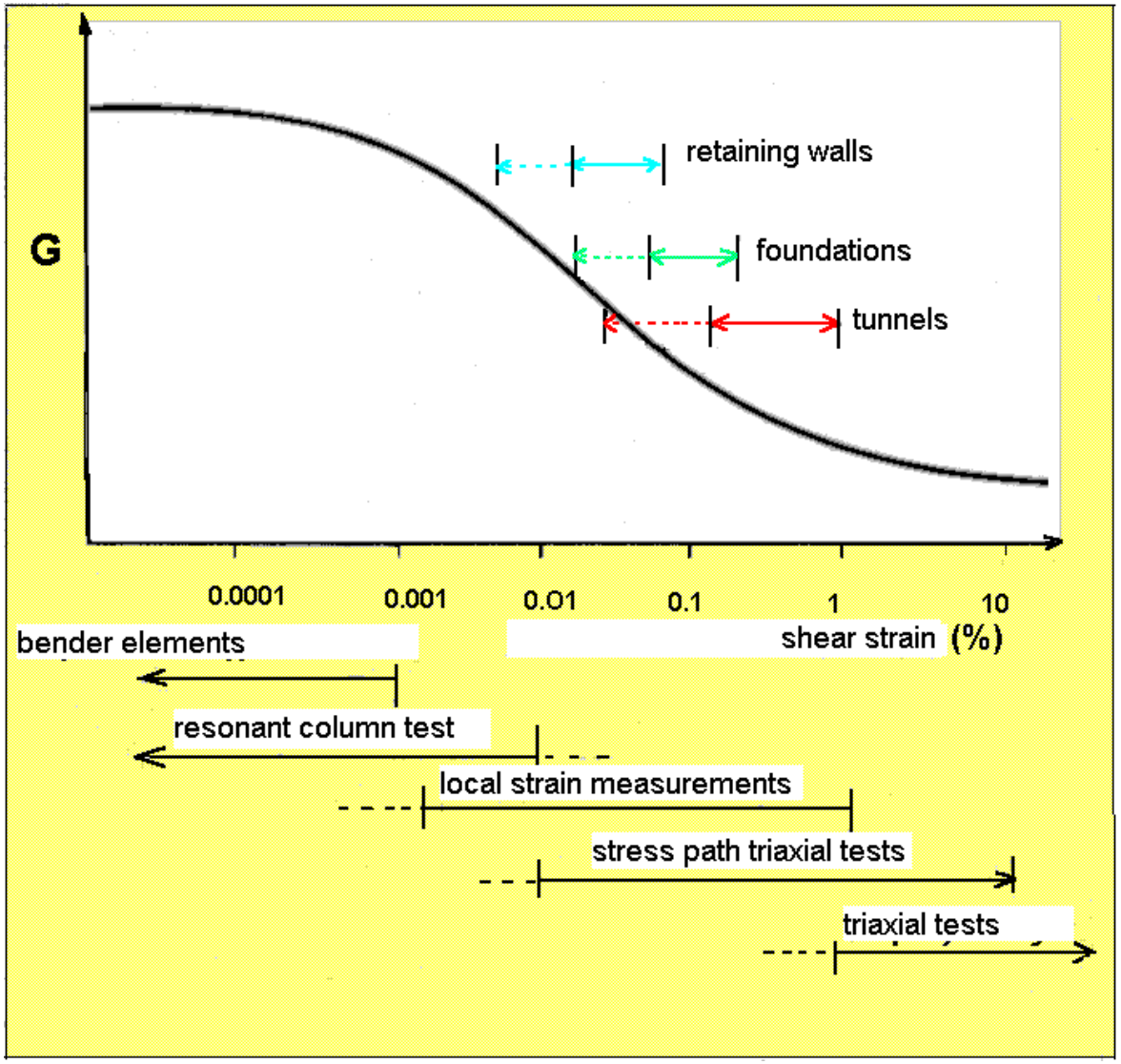
$\varepsilon=Dh/H$

$G=\tau/\gamma$

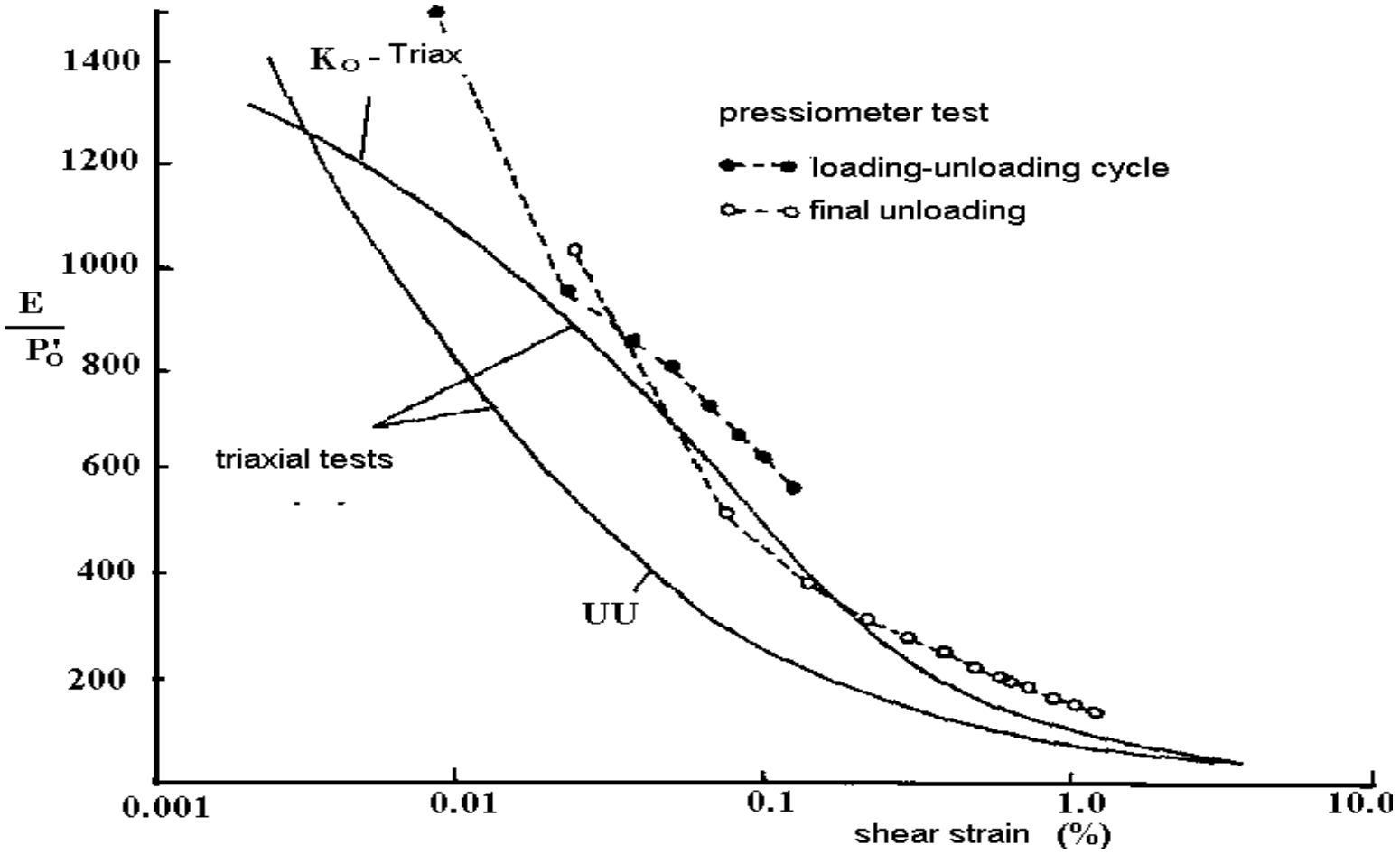
Soil Stiffness

- The shear modulus drops by a tenfold

- Elastoplastic stress-strain relationships should be used in numerical analysis



Laboratory vs site measurements



Analysis of a geotechnical problem

1. Estimate the stress field for e.g. an excavation of a cut, construction of a fill, a long strip footing etc.

2. Estimate the deformation/strain resulting from this stress distribution

3. 'sum' the strains in the soil elements and make predictions about the response of the soil and structure (stability, displacements)

-interaction of the above steps (e.g. finite element method)

-step 2 requires the determination of generalised stress-strain relationships in the laboratory to be used in constitutive modelling (step 3)

Types of Diaphragm walls

Secant pile wall

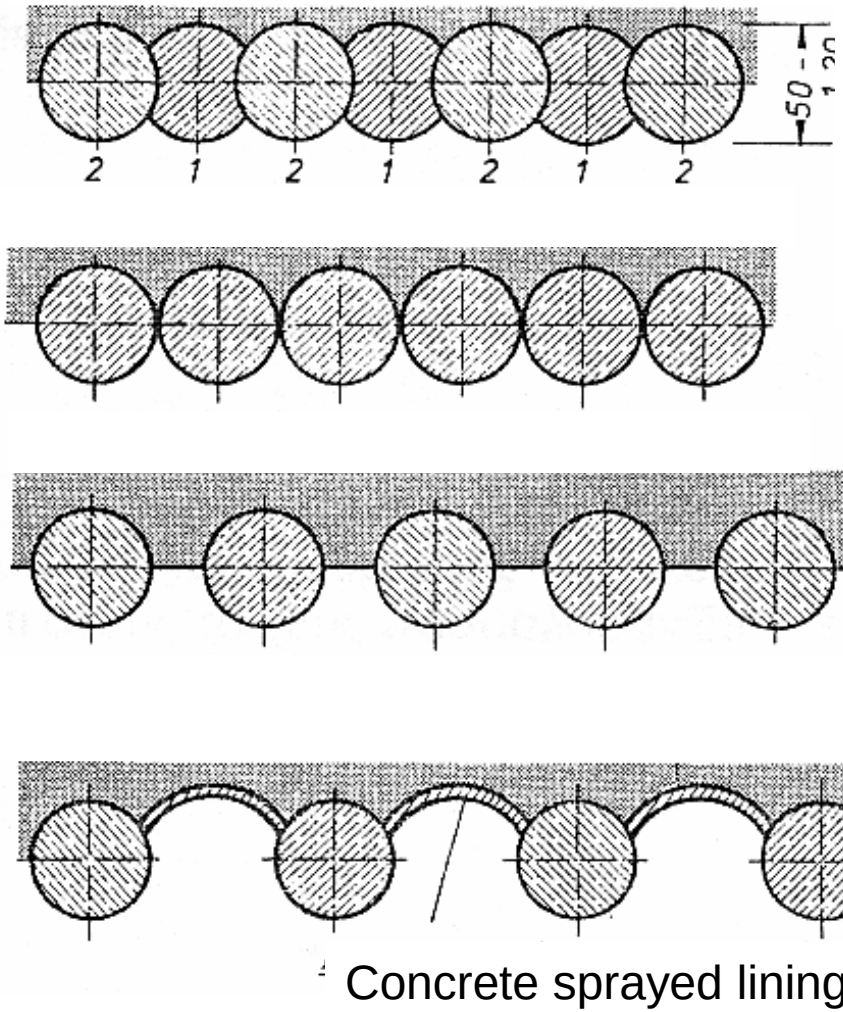
0<a<1D,

a=distance between piles, D=pile diameter

Contiguous pile wall

1D<a<2D

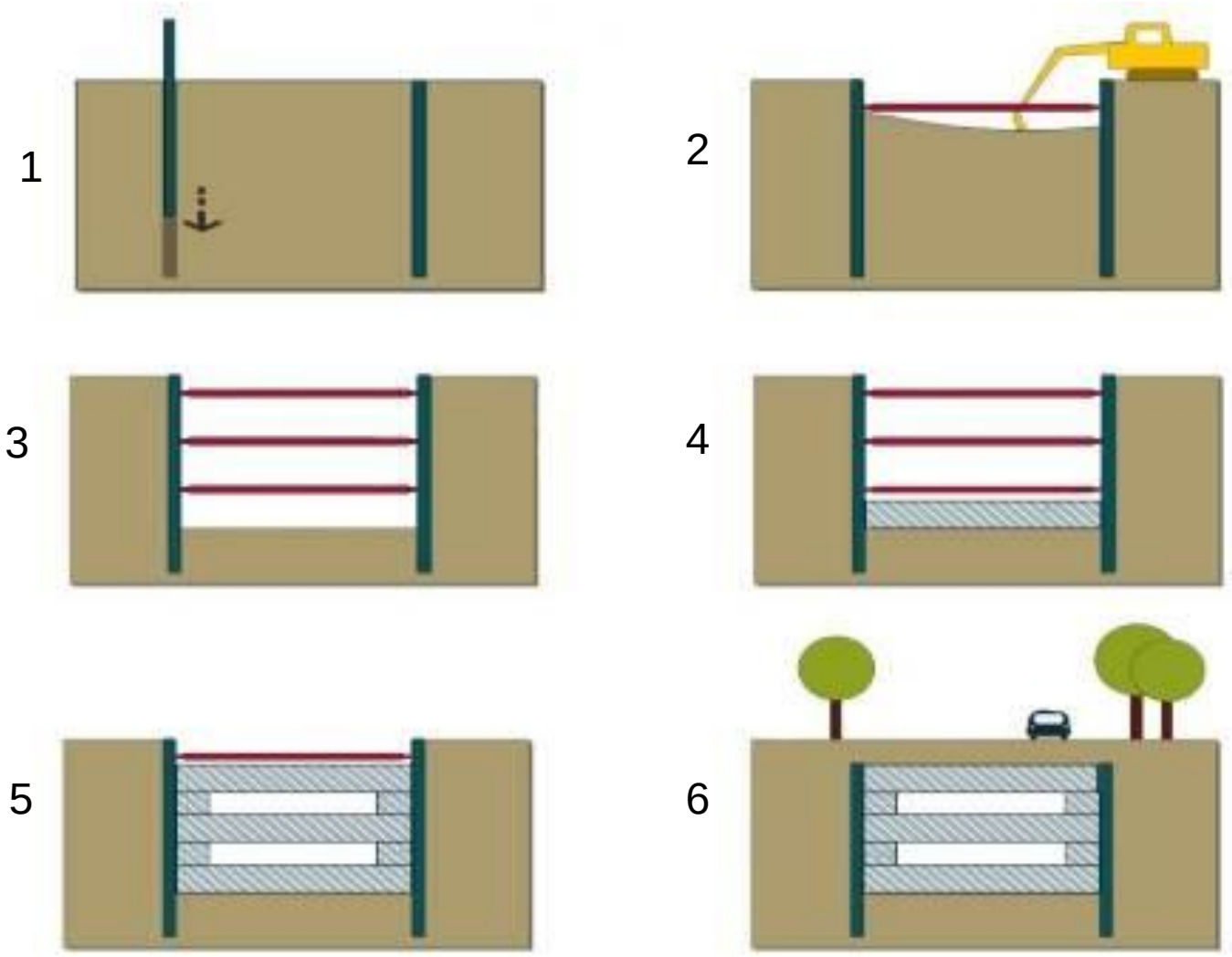
- a >2D



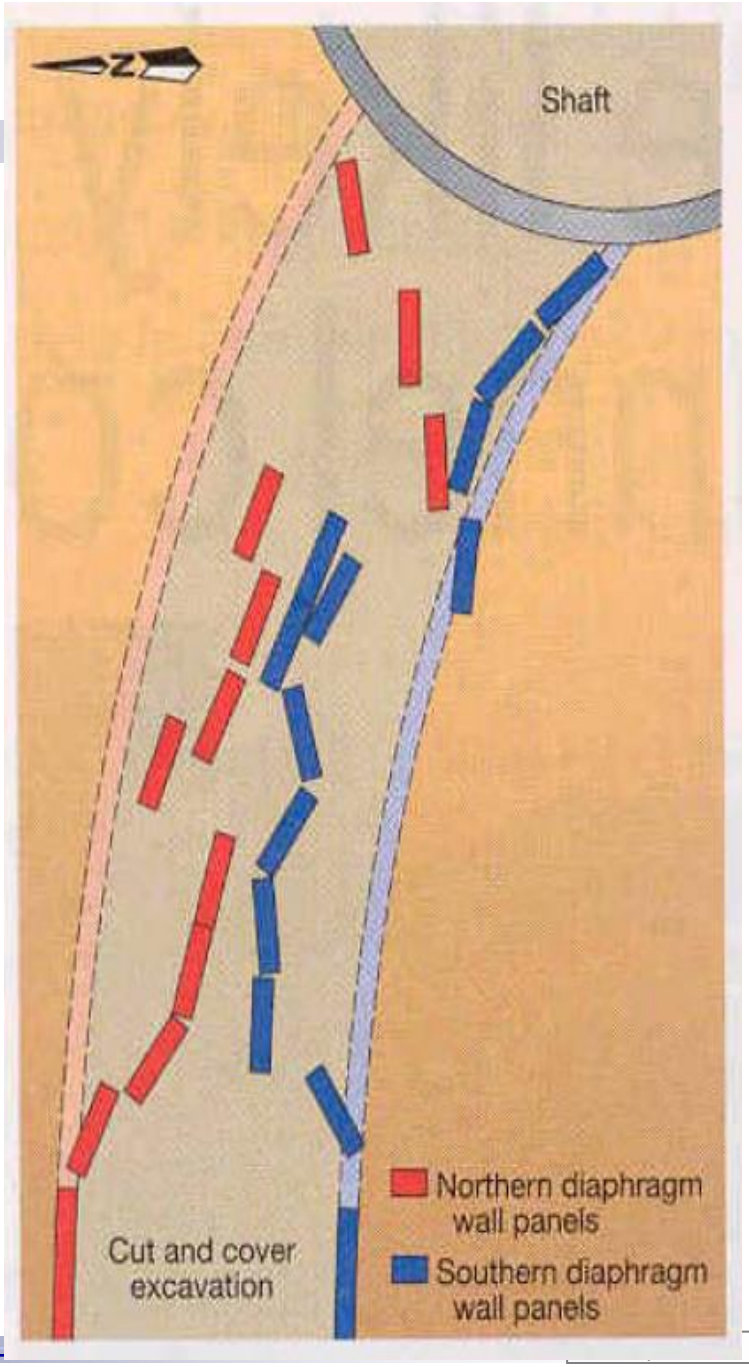
1. Conctere piles formed first
2. Reiforced concrete piles follow

Concrete sprayed lining

MULTI-PROPPED RETAINING WALLS



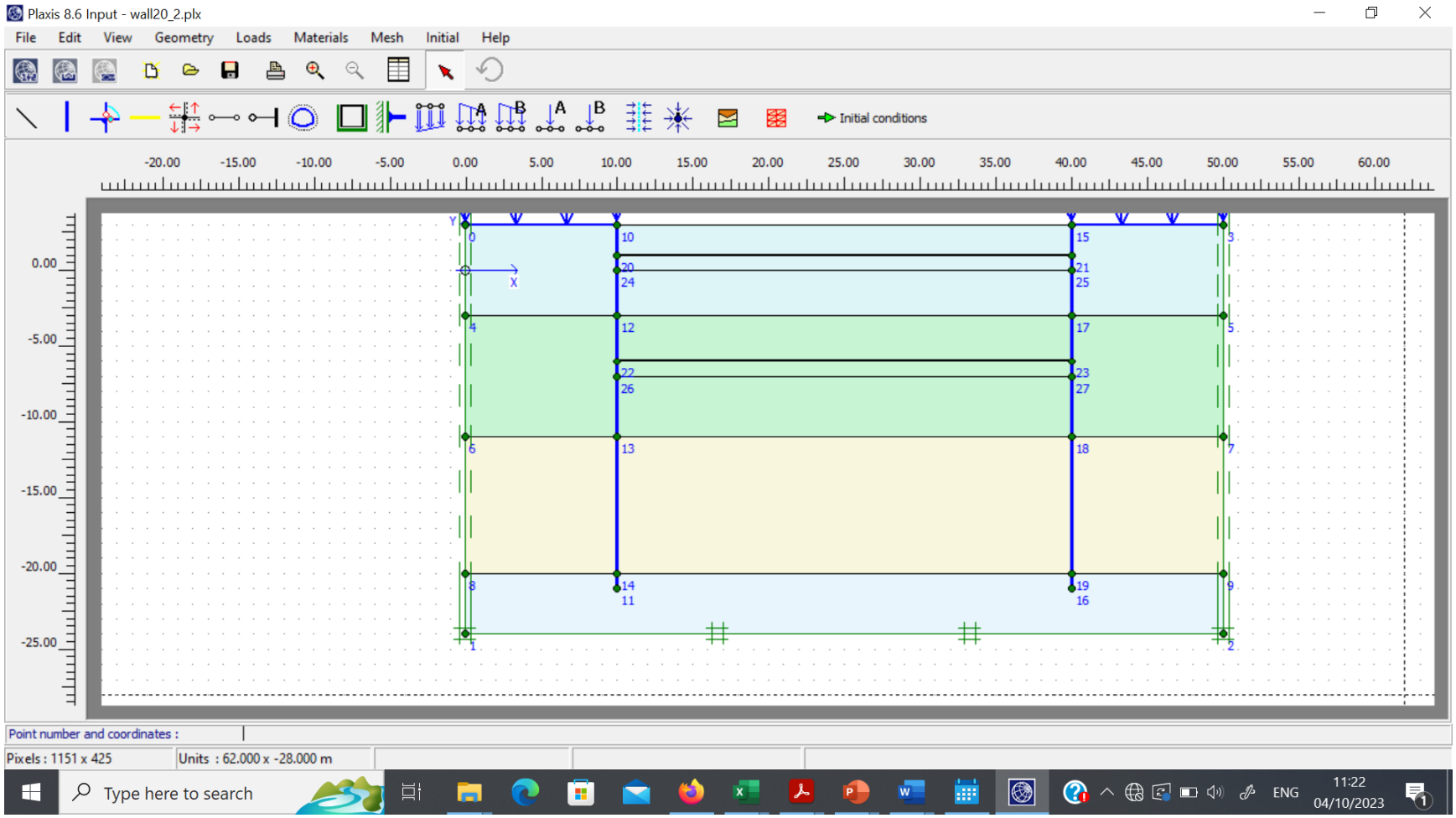

New Civil Engineer
nce
www.nceplus.co.uk
Magazine of the Institution of Civil Engineers
29 April 2004
Singapore cut and cover collapse


Shaft
Cut and cover excavation
Northern diaphragm wall panels
Southern diaphragm wall panels

3. Mechanisms of ground deformation due to deep excavations

- Multi-propped deep excavations: a case study of a multi-propped excavation at Thesaloniki is analysed using computer program **Reward** (British Steel, 2003) and compared with FE program PLAXIS
- Response of retaining walls to seismic loading
- Seismic regulations

Case study-1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Initial conditions
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0.00 -5.00 -10.00 -15.00 -20.00 -25.00
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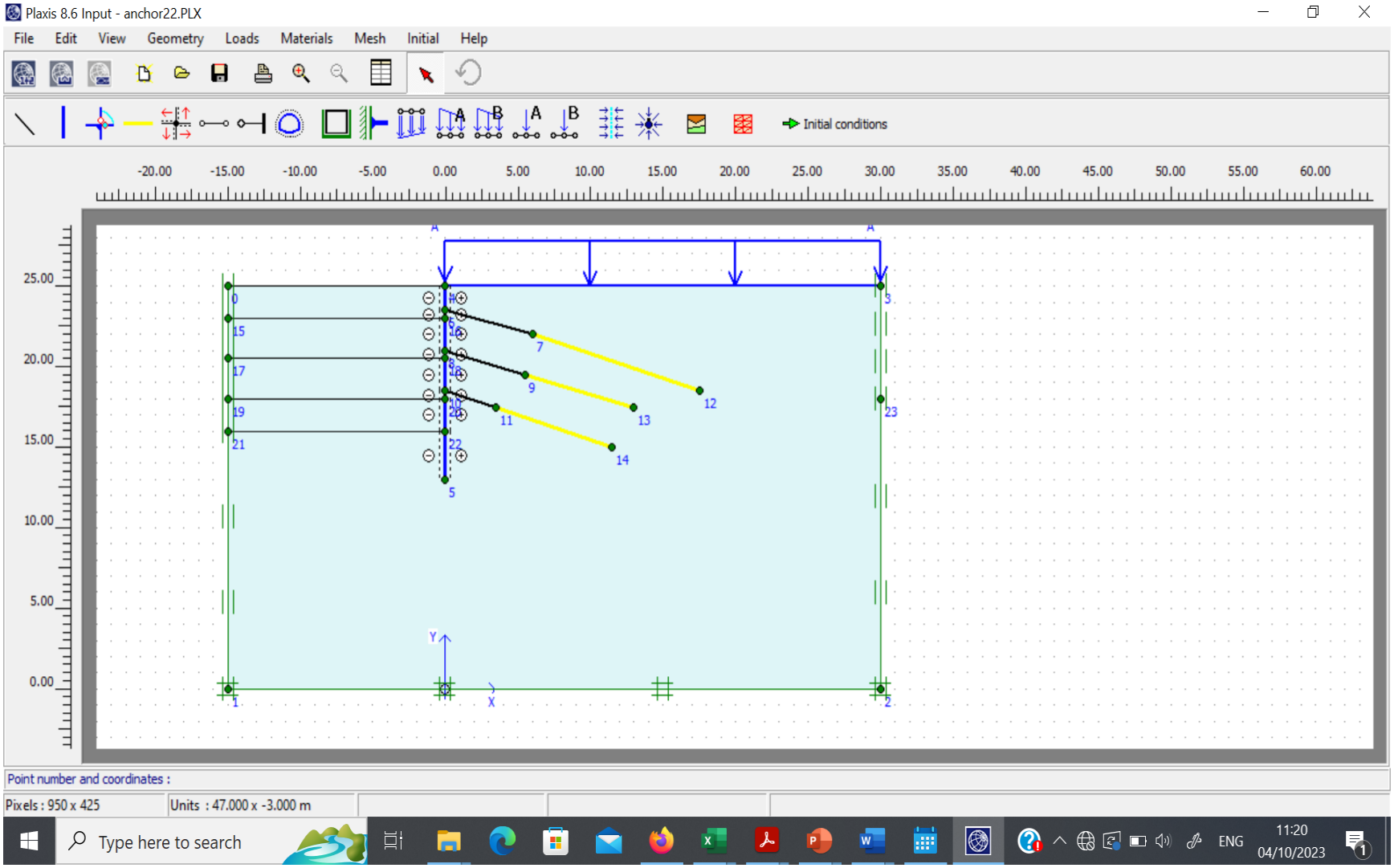
Type here to search
ENG
11:22
04/10/2023

Case study-2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25.00 20.00 15.00 10.00 5.00 0.00
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Pixels : 950 x 425
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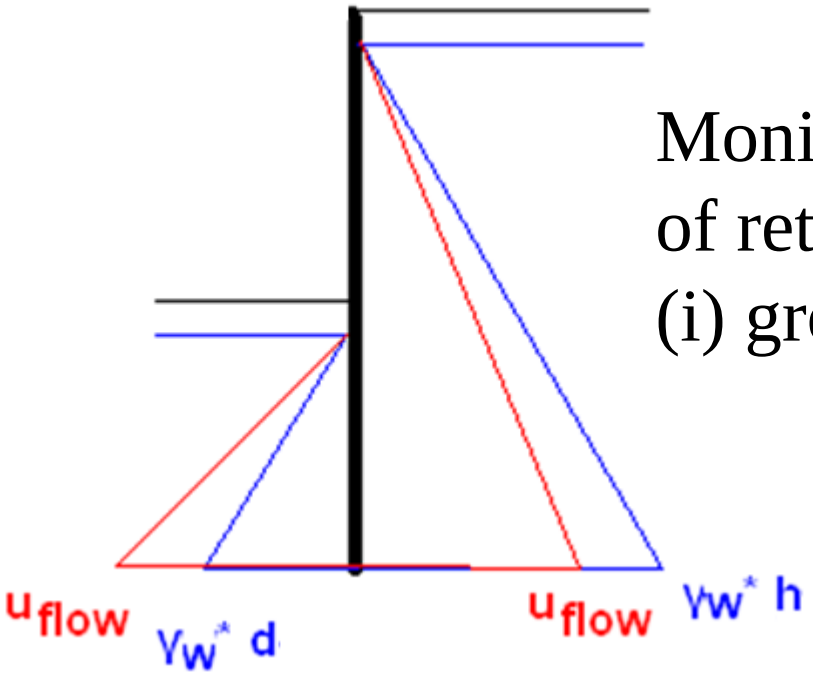
Type here to search
ENG
11:20
04/10/2023



Monitoring the performance of retaining structures:
(i) ground water flow

2. Flow of water in soils

Practical examples of seepage + construction of flownets by sketching

Diava bridge, 2016

Scouring (soil erosion around the pier foundation of the bridge)

Pier protection of scouring

4. Soil nailing – Reinforced earth

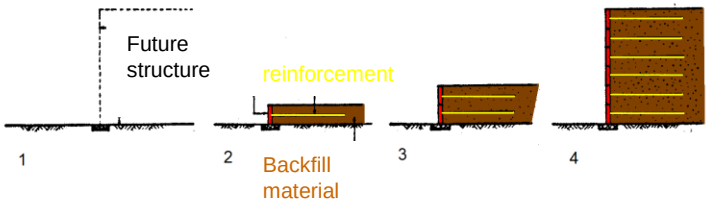
- Use of the limit equilibrium program **"ReActive" and FE program PLAXIS**

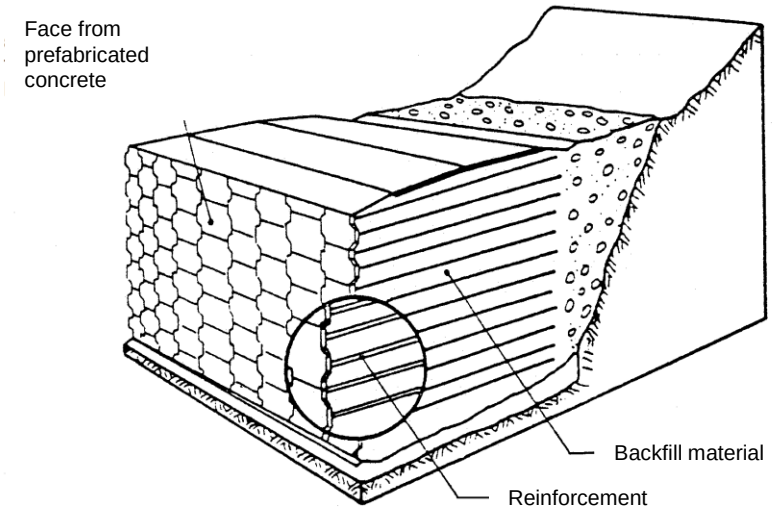
Case study: reinforced slopes along

'Egnatia Motorway'

REINFORCED EARTH

- Reinforced earthfill wall





5. Geotechnical instrumentation for monitoring field performance

- Measurement of Groundwater pressure in soils
- Measurement of Stress and Deformation in soil
- Measurement of Load and Strain in Structural Members

http://geolab.civil.ntua.gr

Objectives and related projects

- Calculation of settlements (Project 1: Pisa)
- Design of retaining walls – limit equilibrium solutions including EuroCode 7 (Project 2: ReWard / Plaxis)
  - Response of retaining walls to seismic loading– National Standards (NEAK)
- Monitoring the performance of retaining structures: ground water flow & instrumentation for the measurement of stress, groundwater pressure and deformation
- Design of earthfill walls using soil nailing and earth reinforcement techniques (Project 3: ReActive / Plaxis)