

Lecture 25

NPTEL Course

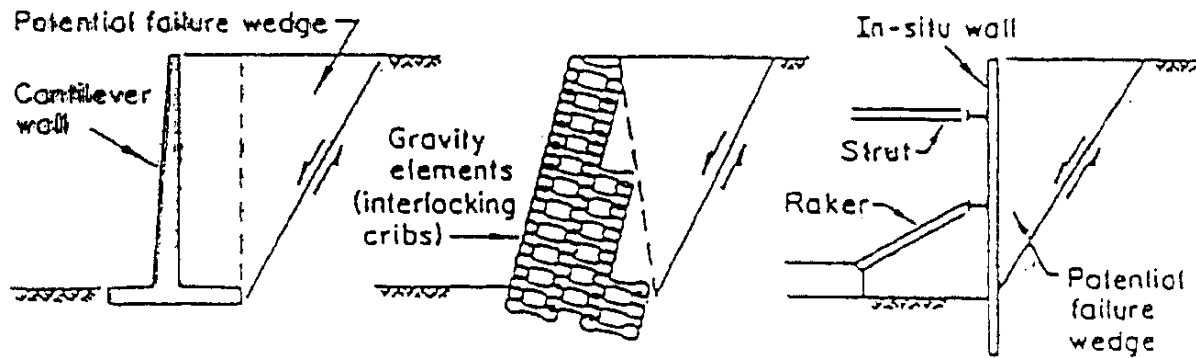
**REINFORCED SOIL
PRINCIPLES AND MECHANISMS**

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Introduction

An externally stabilised system such as cantilever retaining wall uses an external structural wall against which stabilising forces are mobilised.

An internally stabilised system such as reinforced earth involves reinforcements installed within and extending beyond the potential failure mass

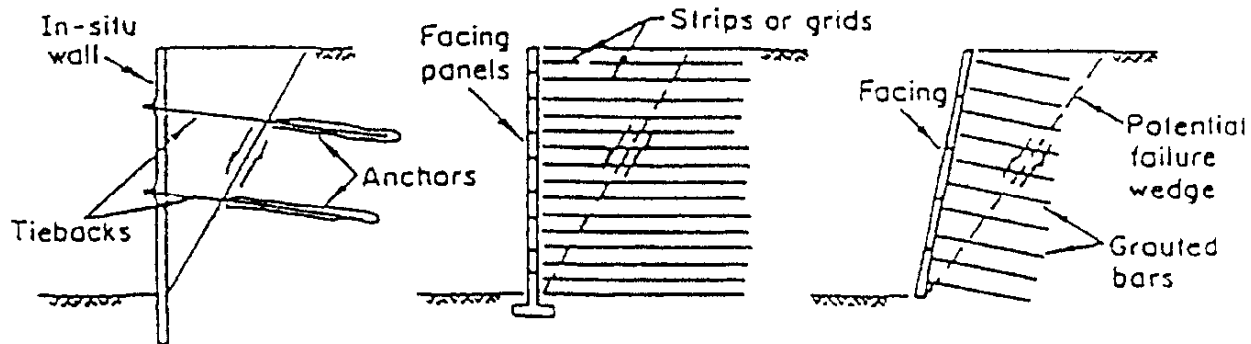


a) Cantilever

b) Gravity Element

c) Braced

EXTERNALLY STABILIZED SYSTEMS



d) Tied-Back

e) Reinforced Soil

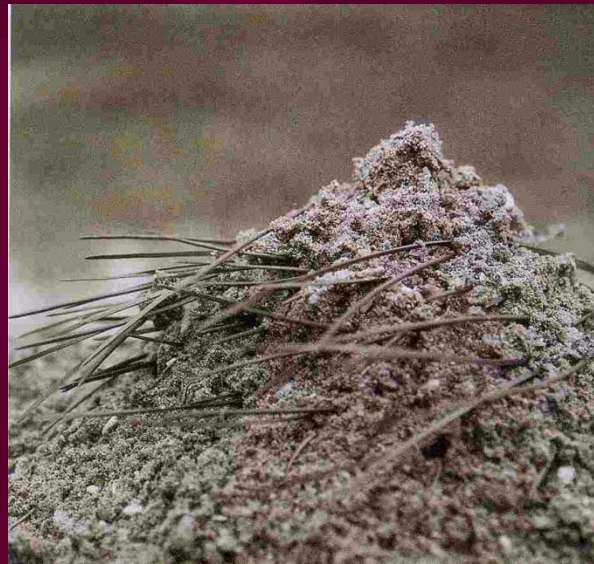
f) Soil Nailing

EXTERNALLY STABILIZED

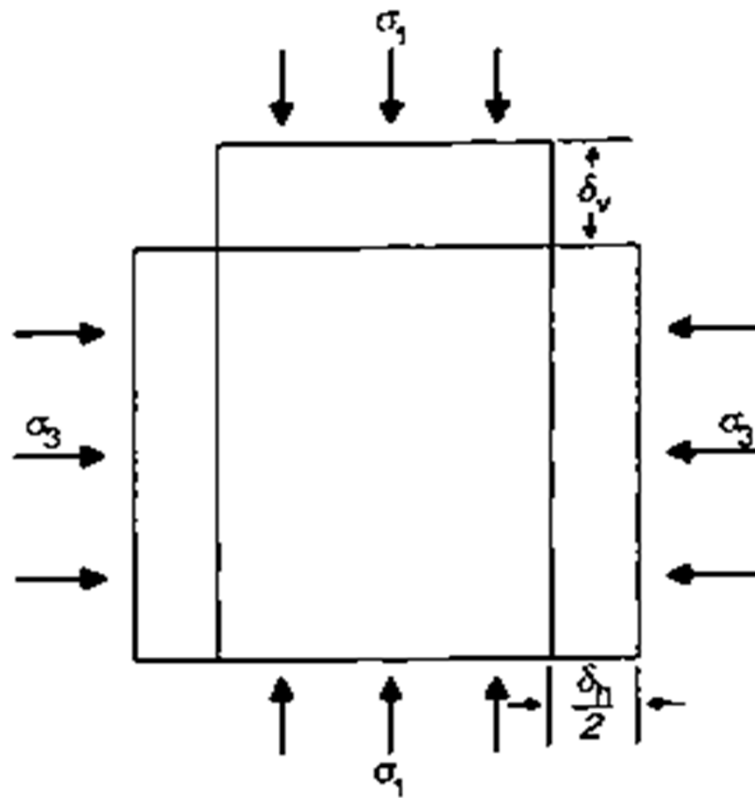
INTERNALLY STABILIZED SYSTEMS

Introduction

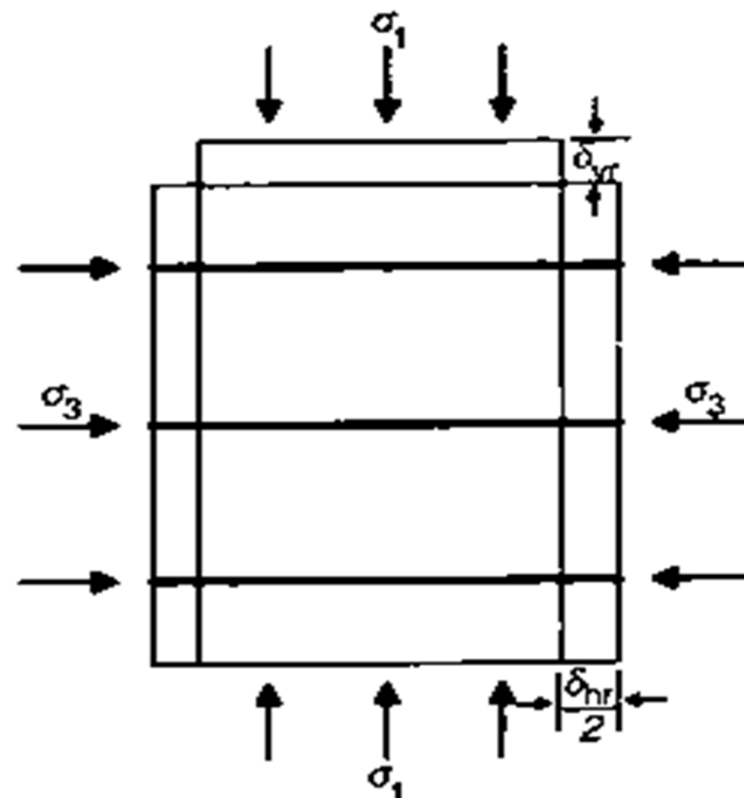
⌘ Soil reinforcement is a construction technique that depends on friction between soil and reinforcing element leading to tensile force mobilization.





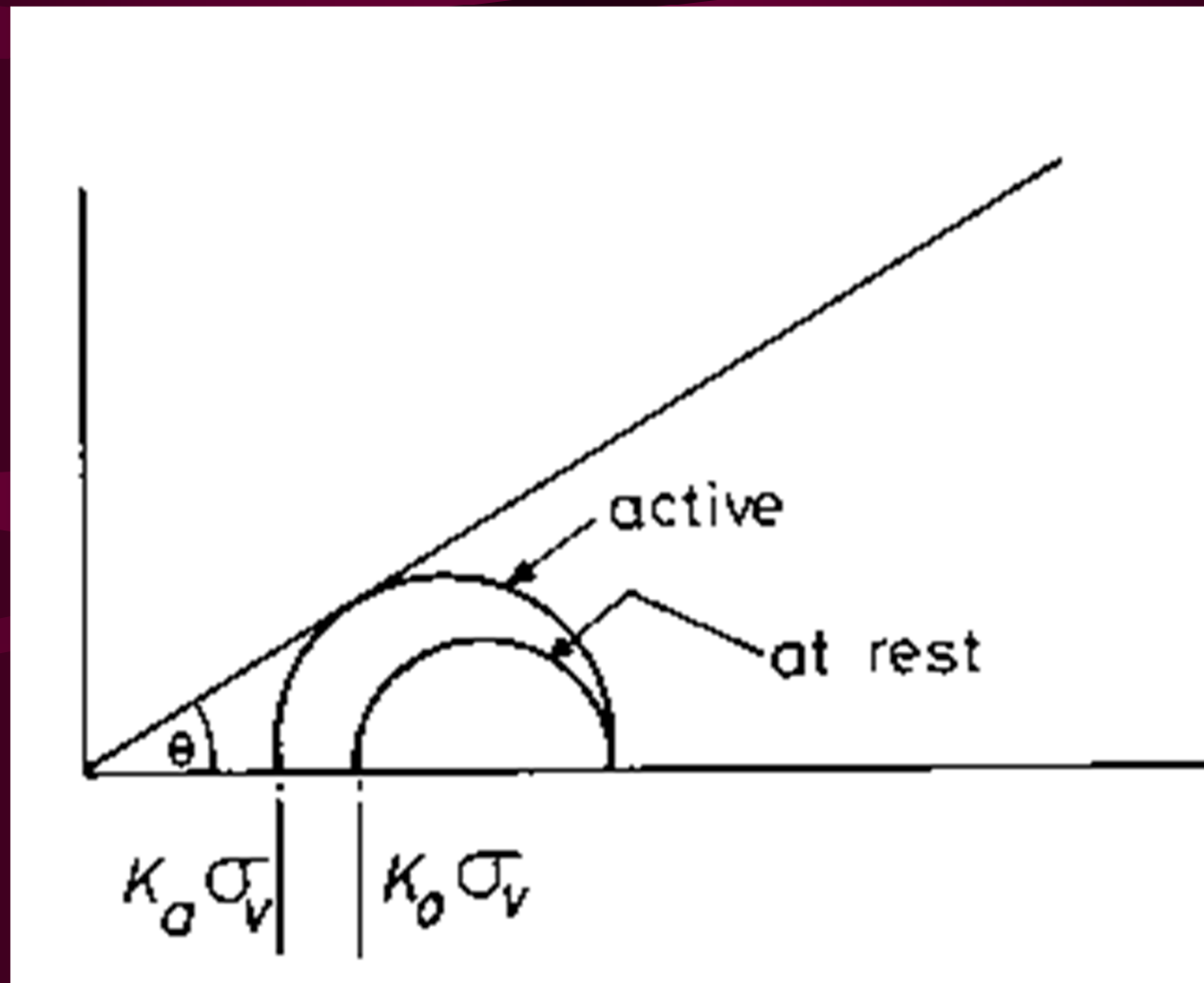


a) Unreinforced

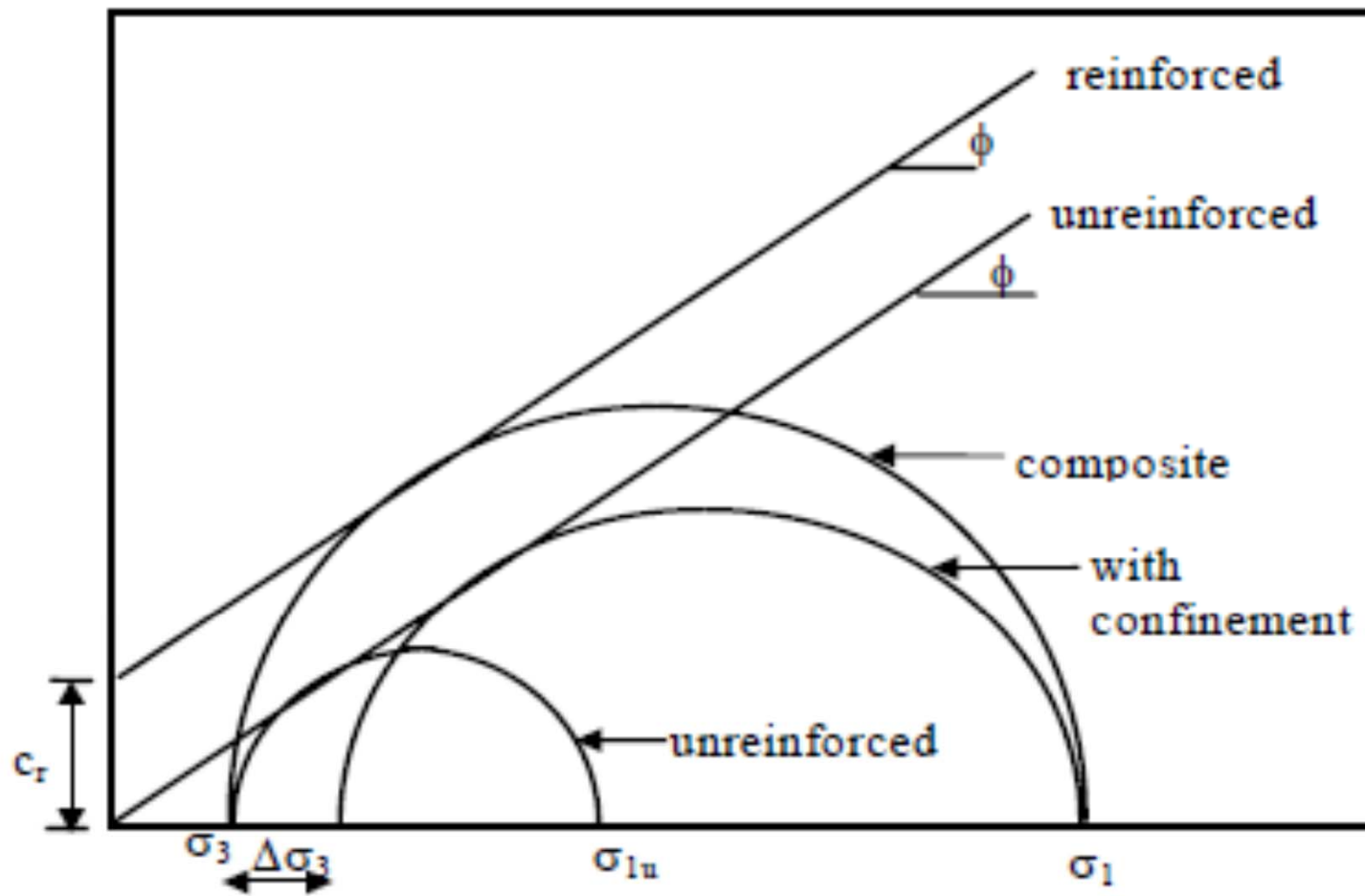


b) Reinforced

Reinforcement introduces pseudo-confining pressure



Failure occurs either due to tension or pull out of reinforcement



Components

- **The reinforcing elements (strip, grid or sheet, fabricated from metals or geosynthetics)**
- **Facing units to prevent the soil from erosion (Pre-cast concrete panels, metal sheets and plates, gabions, welded wire mesh, shotcrete, wrapped sheets of geosynthetics)**
- **Backfill materials (local soils, specified soils, marginal materials)**

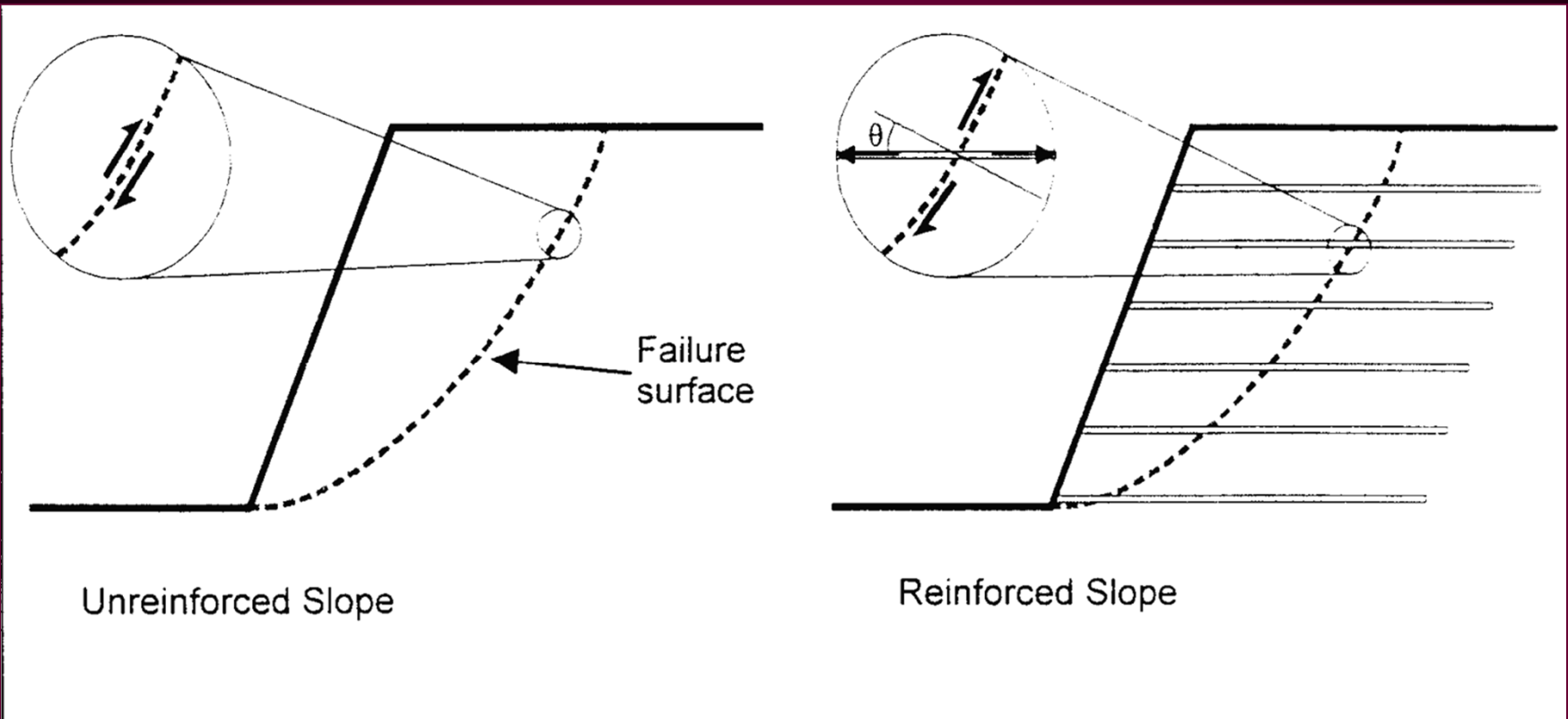
Technical Benefits

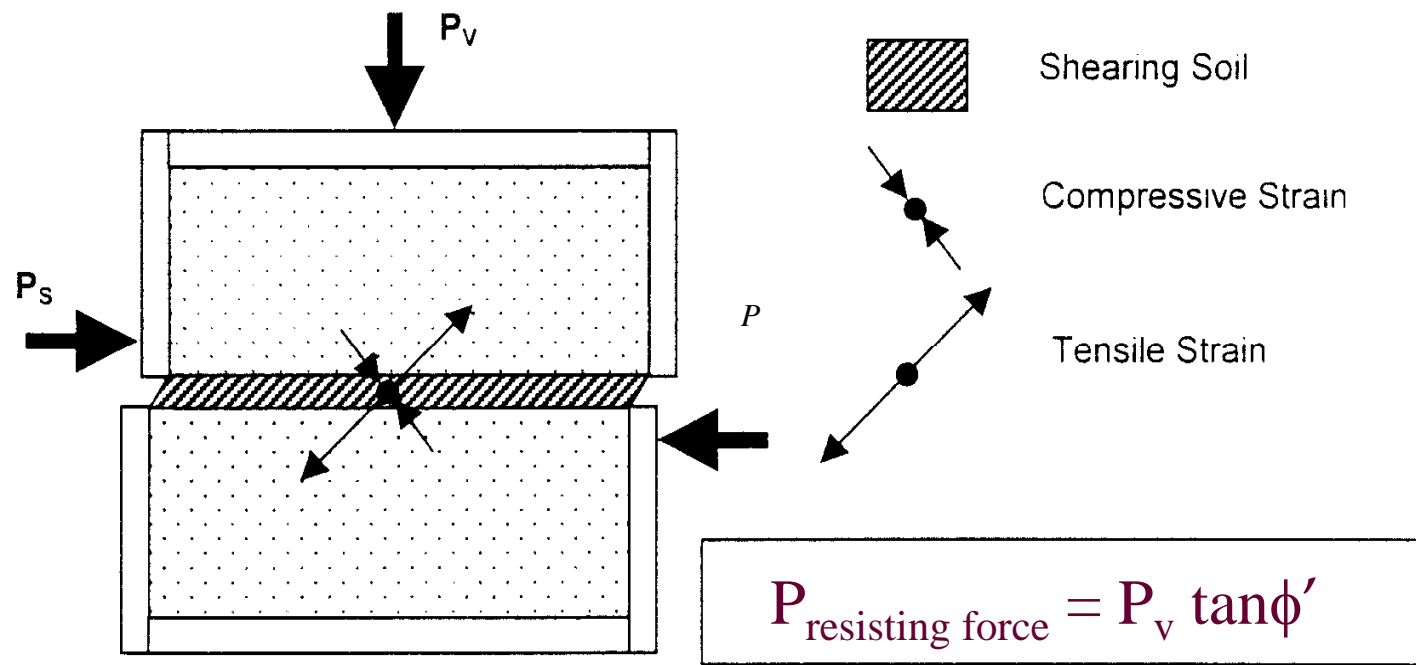
- **Reduce the forces in the soil, which cause failure**
- **Shearing resistance of soils does not dominate design**
- **Efficient use of materials (shear resistance of soil with tensile capacity of the reinforcement)**
- **Inherent flexibility and tolerance to deformation**
- **Improved overall performance of the structure**

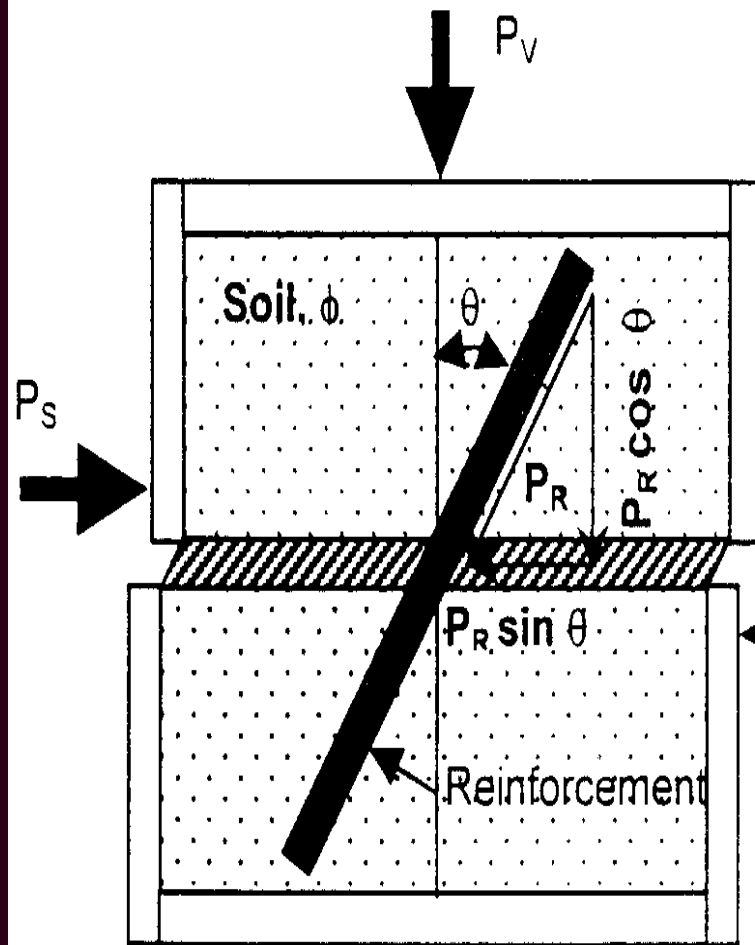
Economic Benefits

- **Cost savings relative to alternative designs**
- **Use of locally available and poor quality soils**
- **Land acquisition can be kept to a minimum**
- **Less construction time on projects**

Mechanisms







Shearing resistance:

From soil alone: $P_V \tan \phi$

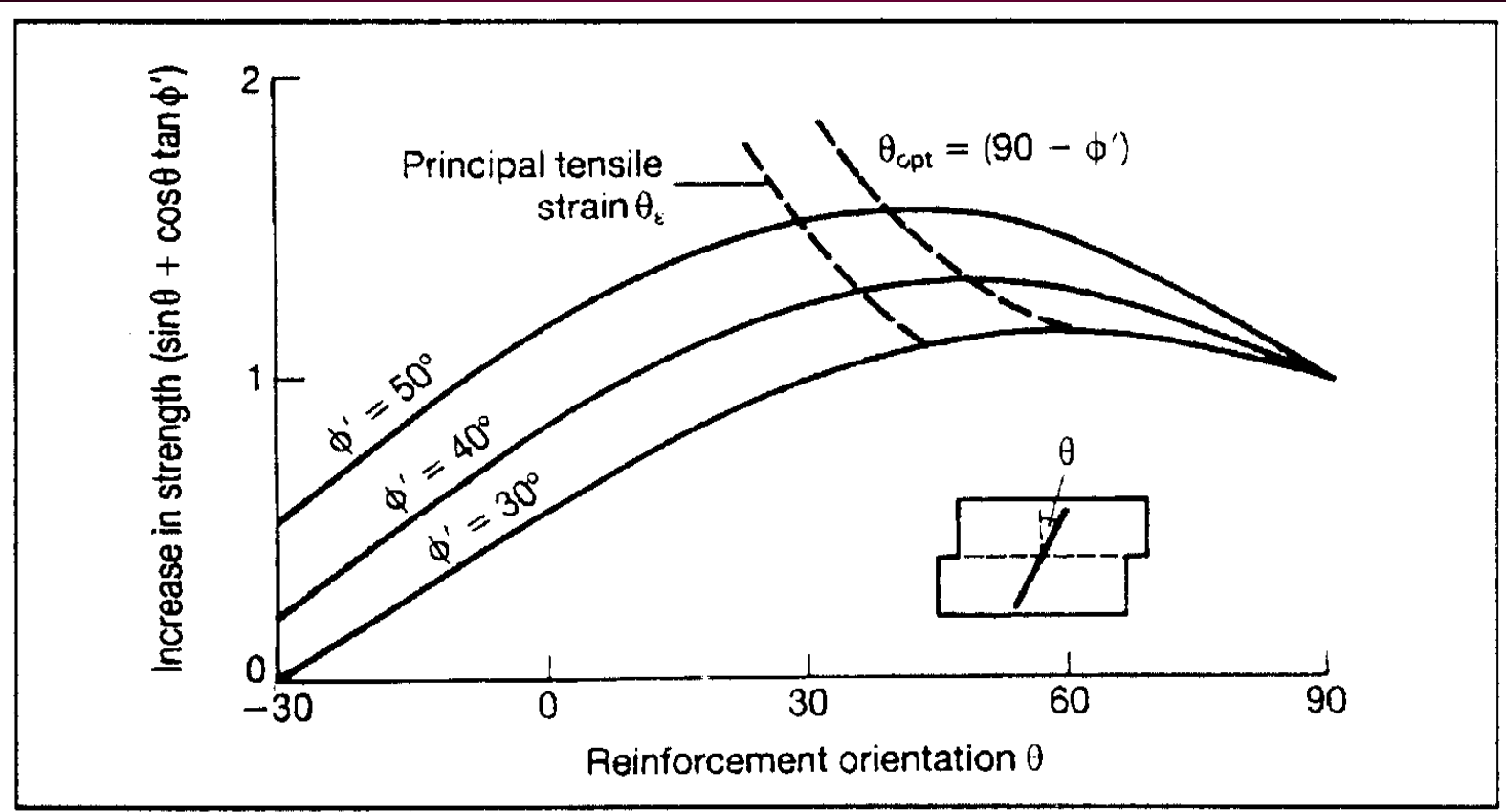
Reduction in shear force: $P_R \sin \theta$

Increase in force resisting shear:

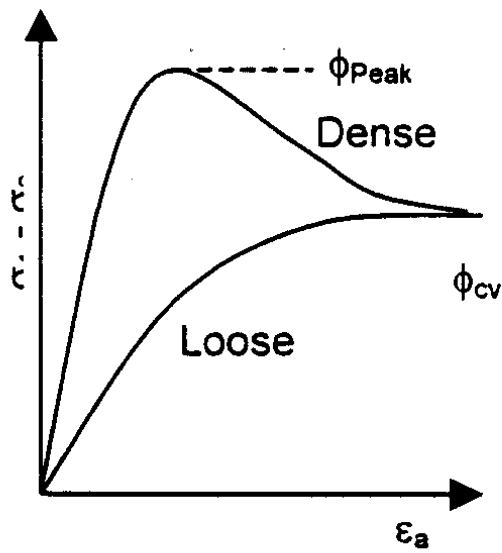
$P_R \cos \theta \tan \phi$

Shearing resistance:

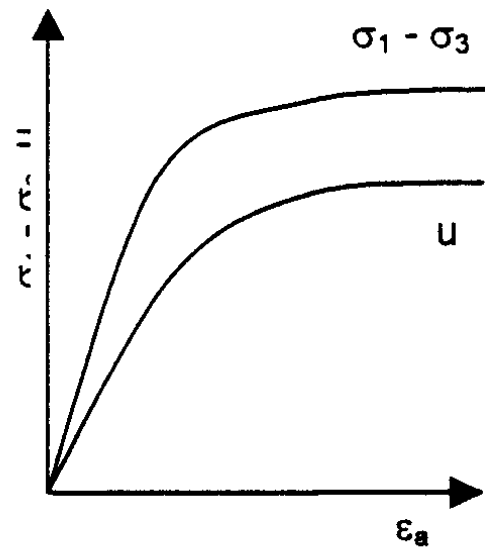
$$P_{\text{resisting}} = P_V \tan \phi + P_R (\sin \theta + \cos \theta \tan \phi)$$



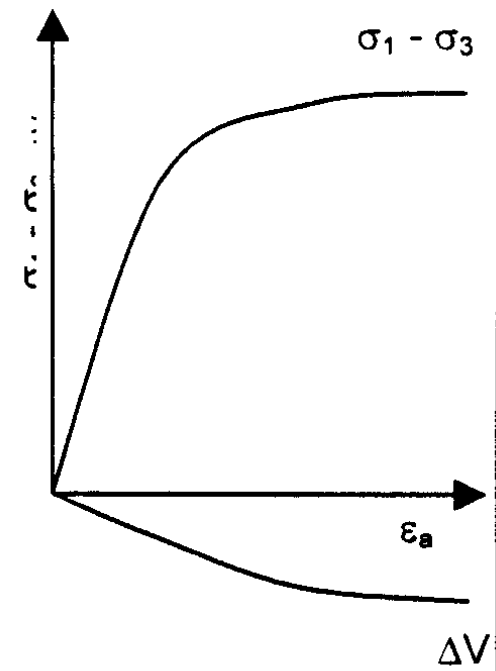
**Drained Triaxial
(SAND)**

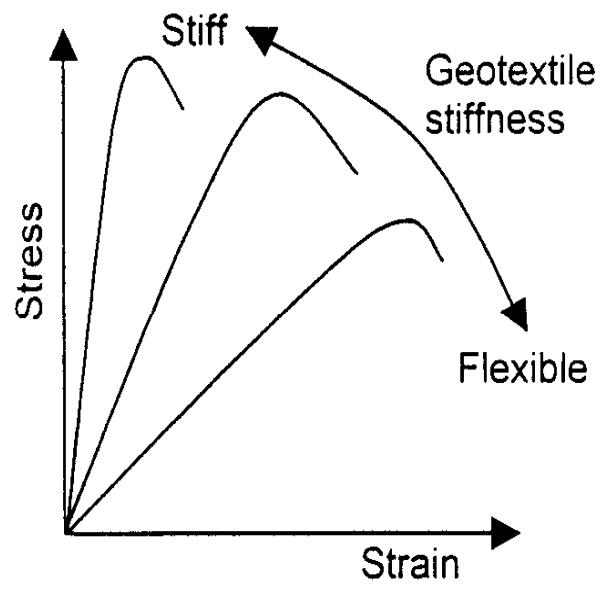


CUTXL (N.C. CLAY)

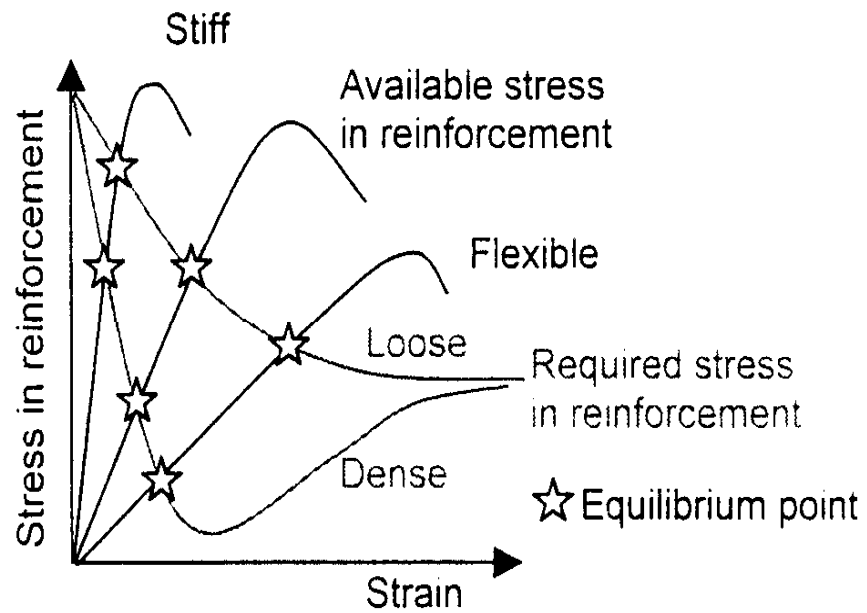


CUTXL (N.C. CLAY)

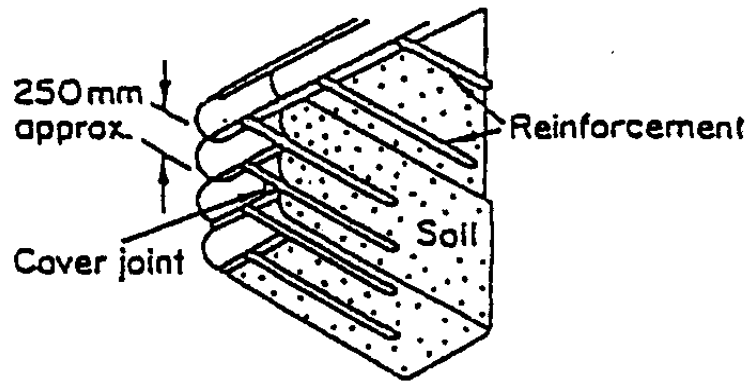




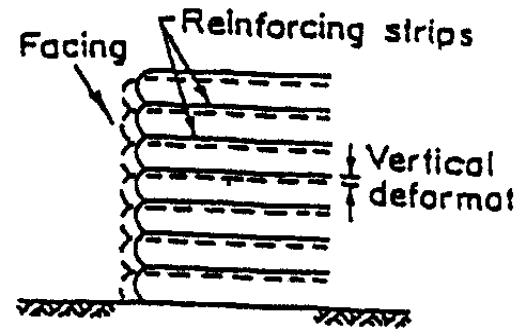
a) Geotextile response



b) Strain compatibility diagram

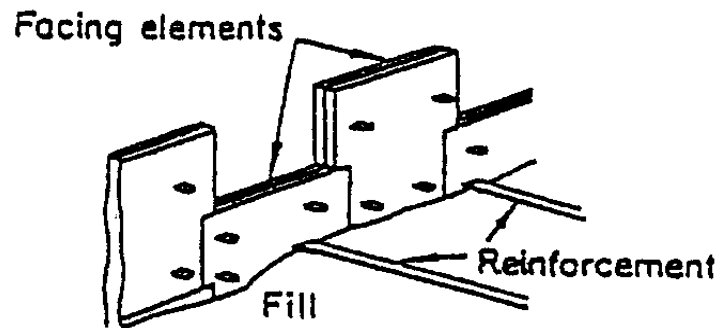


3-D View

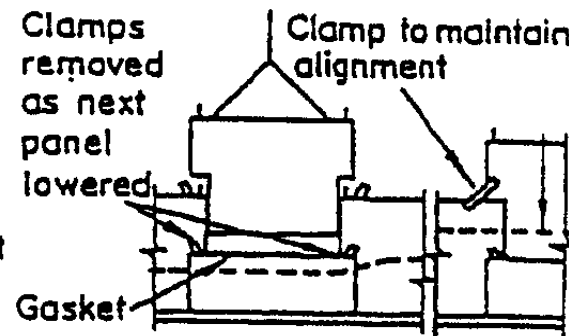


Profile View

a) Concertina Method

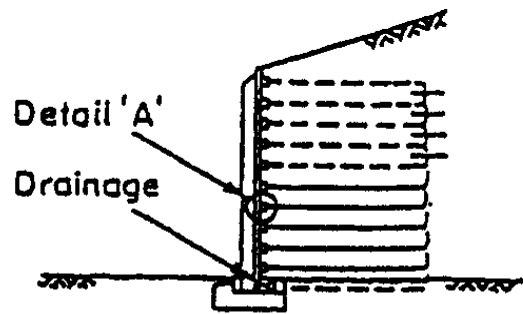


3-D View

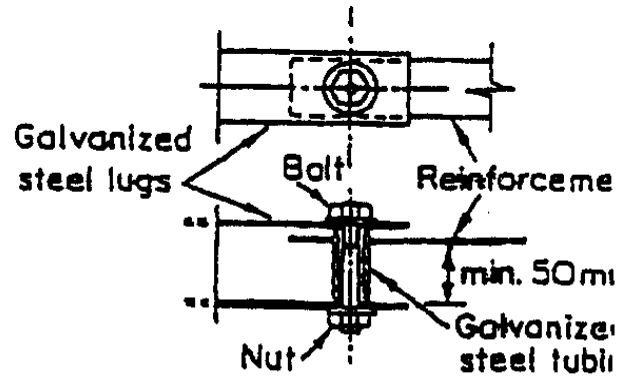


Front View

b) Telescope Method

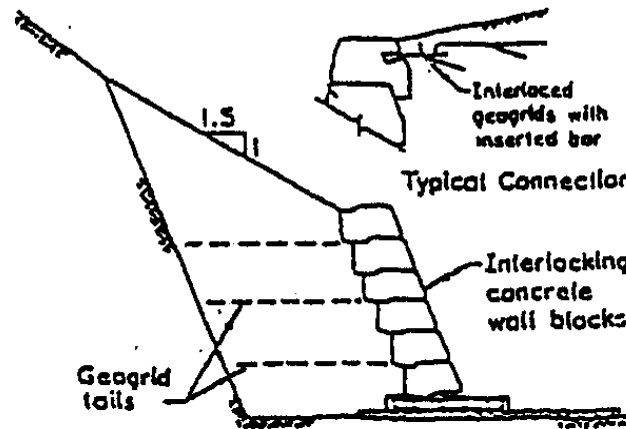
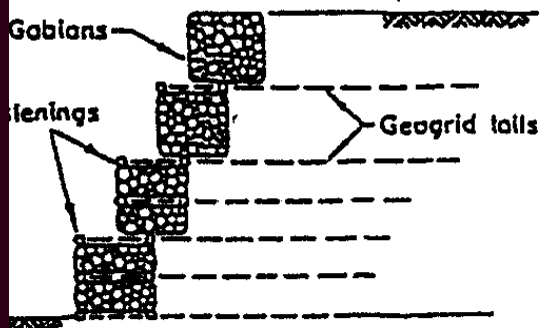


Profile View



Detail A

c) Sliding Method



Typical Connection