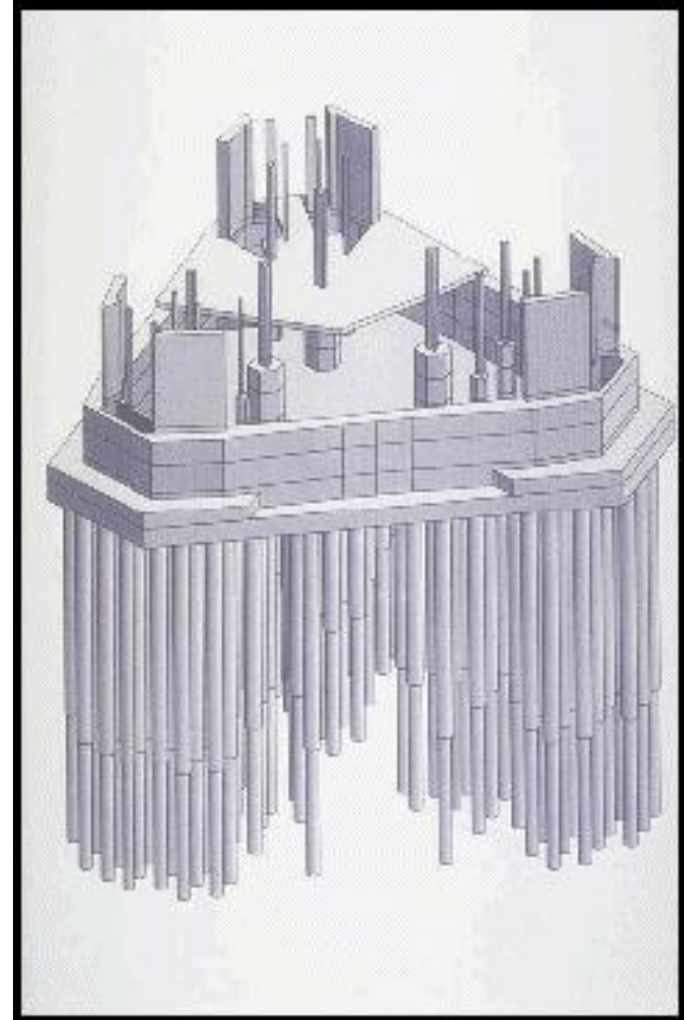


BSc Built Environment Portfolio

The Construction of Deep Basements



Functions of basements

- Provides additional space
- Reduces the net bearing pressure by the weight of displaced soil



Basements



Large box-like foundations that have to withstand both soil and hydrostatic loading.

Collaboration between design and construction.

Methods of Constructing Basements

Battering the sides of the excavation



- Needs space
- Limited depth
- Economical if available

Methods of Constructing Basements



Not practical for excess depths

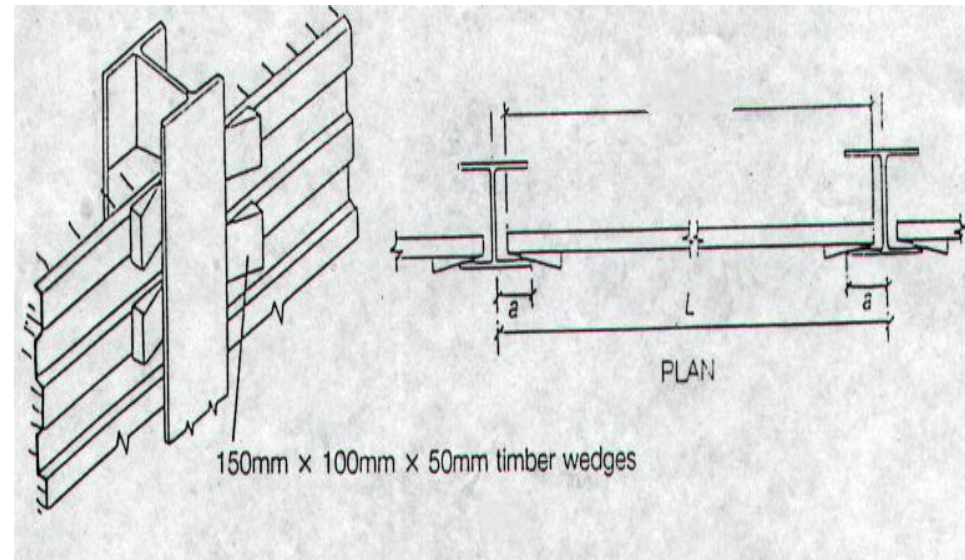
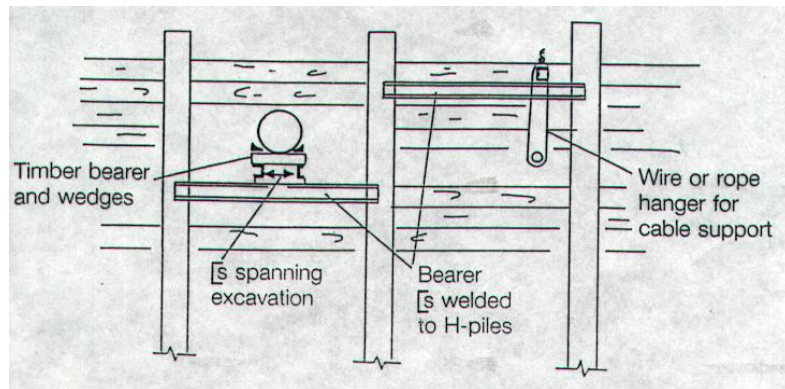
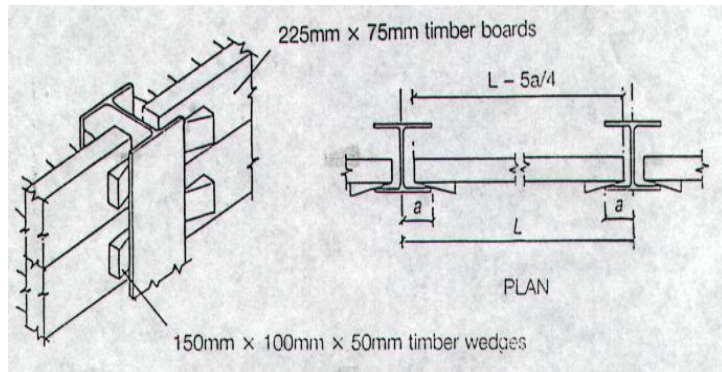
Economical if withdrawal of support permitted

Challenges with water tightness

In excavations supported by timbering or sheet piling



Obstructions



Basement car park





Sheet piles as
Permanent formwork



Methods of Constructing Basements

In excavations supported by reinforced concrete diaphragm walls constructed in advance of the main excavation

- Deep basements
- Obstructions
- Water conditions
- Restrictions



Methods of Constructing Basements

In excavations supported by a contiguous bored pile wall constructed in advance of the main excavation

Troublesome gaps

Water tightness



Secant

Existing constructions

Aesthetics



Support applications



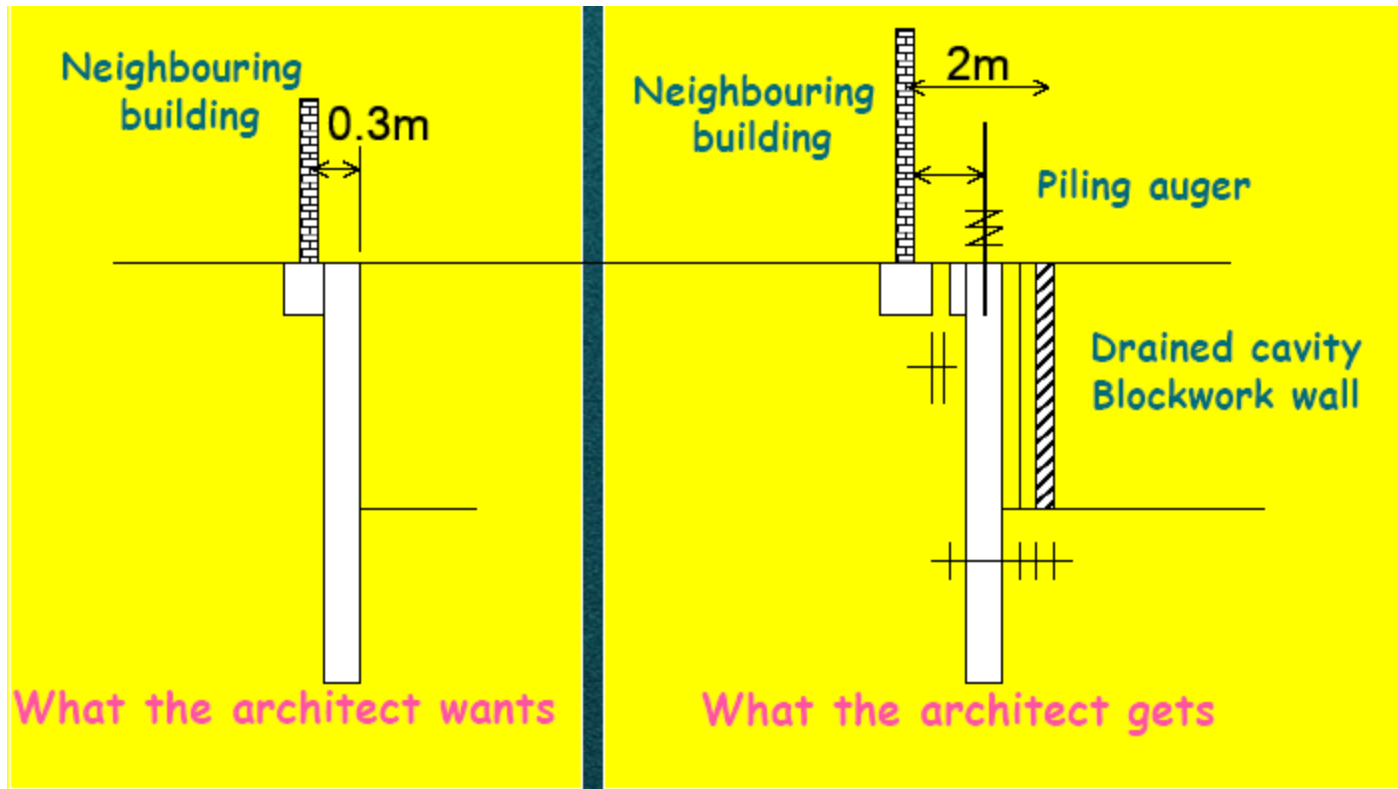
Basement: choice of method

Key factors

- Ground conditions
- Basement depth
- Proximity of buildings
- Complexity
- Time factor



Proximity of adjacent buildings

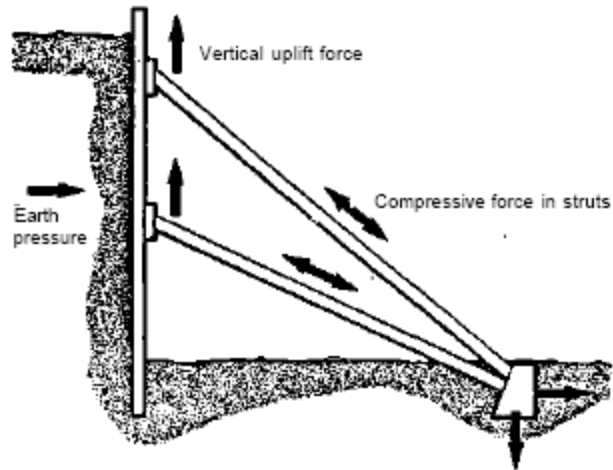


Challenges associated with basement construction

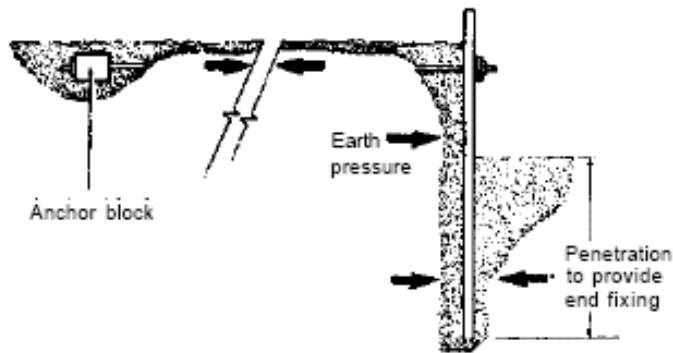


- Lateral movement of excavation face
- Lowering of water table
- Loss of ground
- Elastic deflection

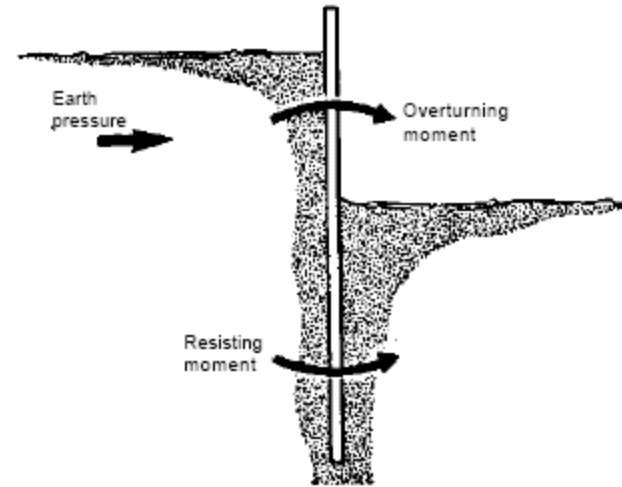
Earthwork support systems



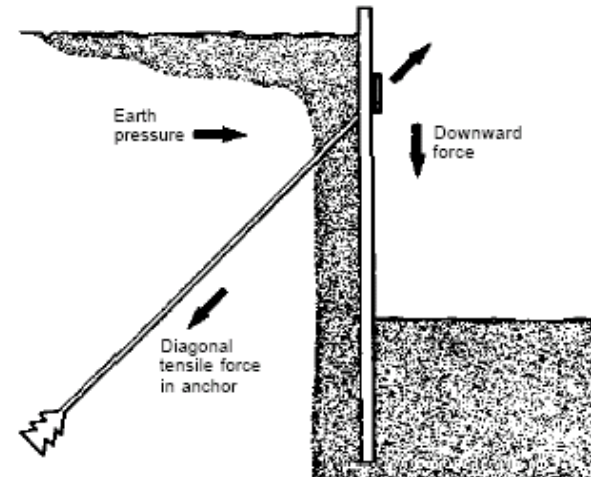
Single sided with raking support



Use of ground anchors



Free cantilever



Propped cantilever

Classifying basements

- Shallow up to 1.5m deep
- Medium 1.5 – 3.0m deep
- Deep more than 3m

Materials timber
 steel
 concrete
 plastics



Performance requirements of support system



- Strength and stability
- Durability
- Watertightness
- Erection and dismantling
- Limited congestion
- Flexibility
- Compatibility



Freedom to work!

Waterproofing



Prevention of overturning

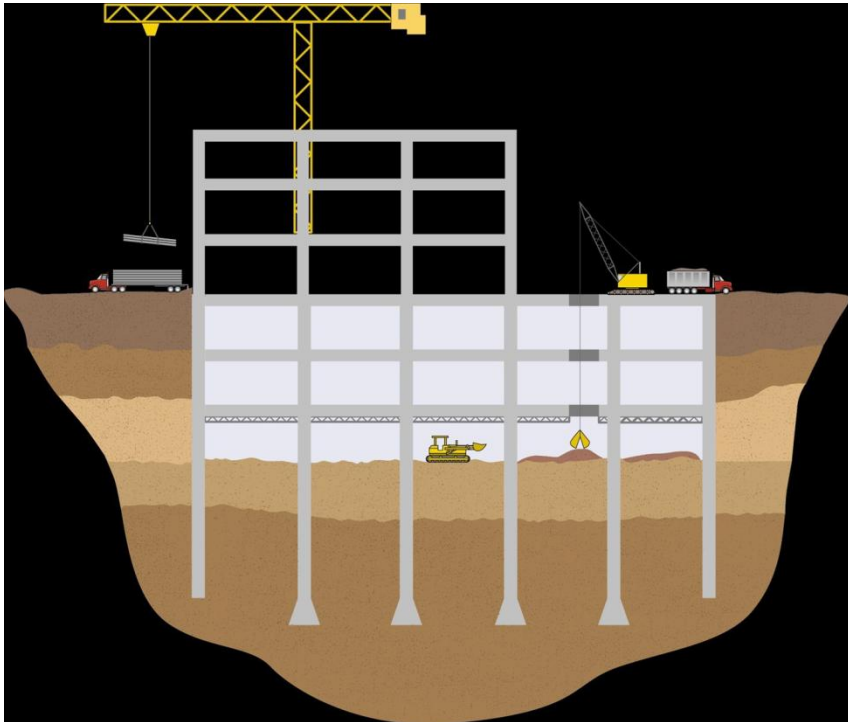
- Cantilever walls
- Ground anchors



- Struts

- Floors

Top down construction



- The structures above ground can be carried out simultaneously with the structures below ground
- This greatly reduces the time for construction
 - By using this approach, settlement can be reduced
 - Since the permanent columns and slabs can be utilized to support loadings during construction, it saves the cost of formwork

Top down construction



- Distance between adjacent building and new building is too close
- Depth of excavation $> 6\text{m}$
- Risk of soil collapse is high during excavation
- Frees up more space
- Water table is too high making it difficult to cast retaining wall

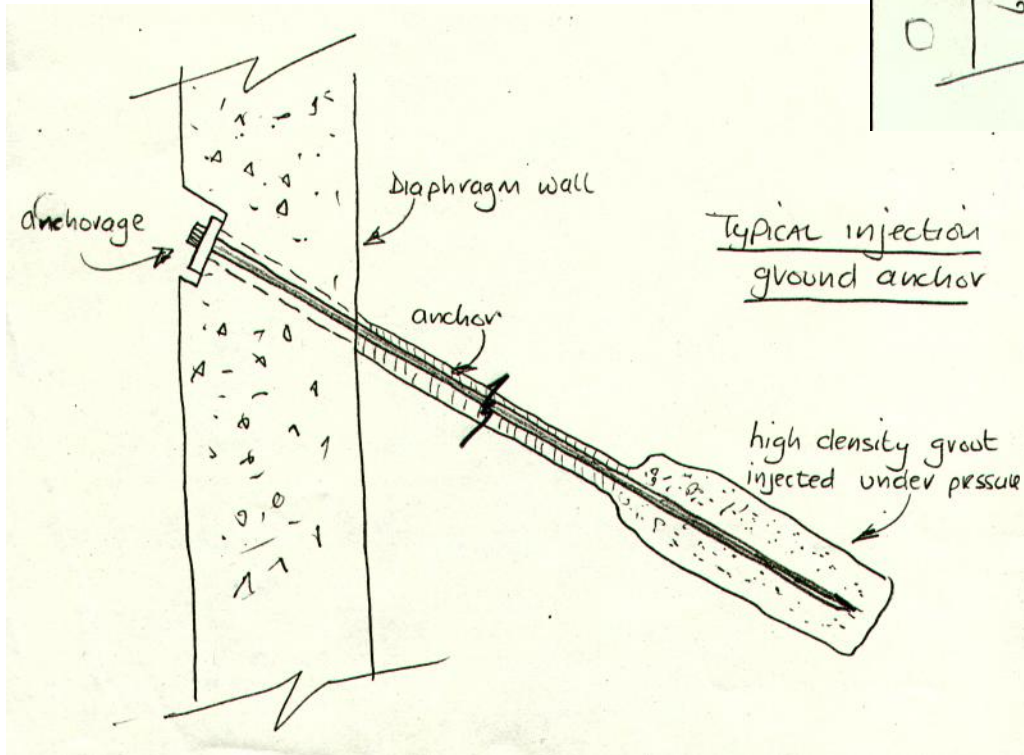
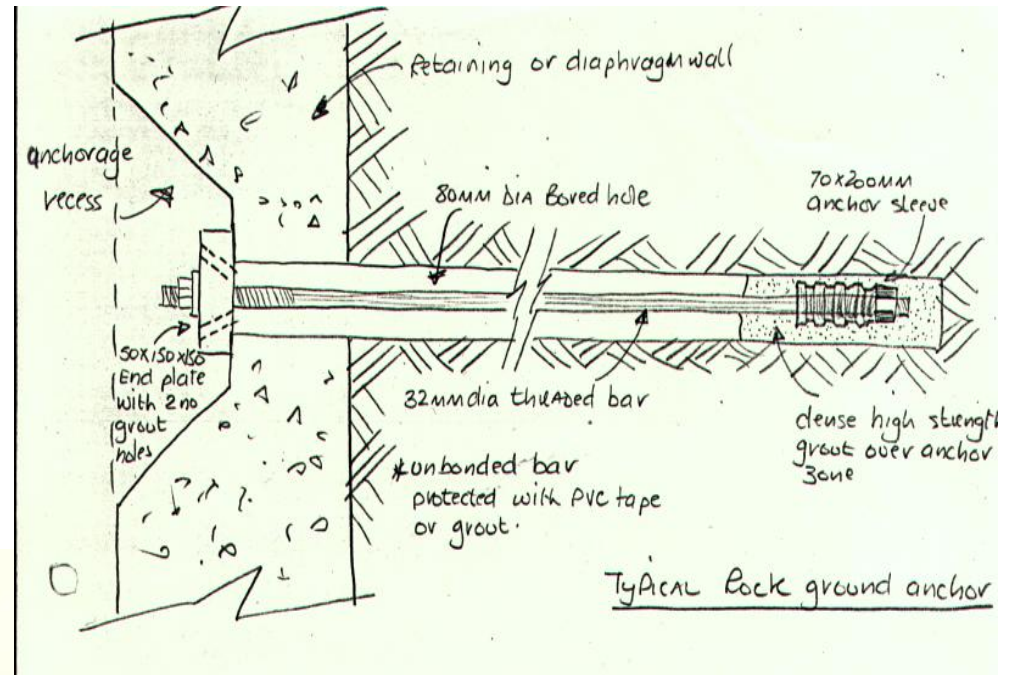


Top down

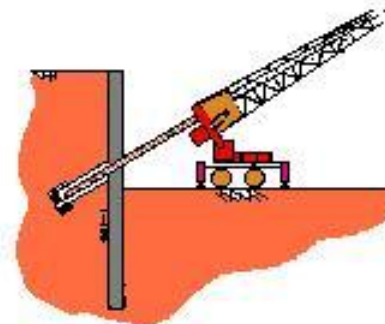
Congestion



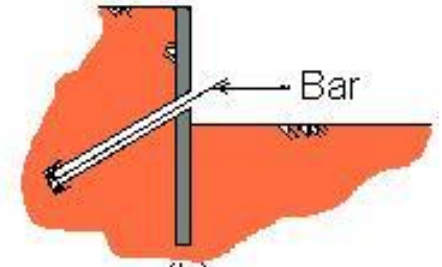
Typical ground anchor applications



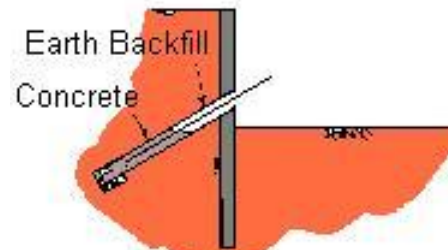
Ground anchor installation



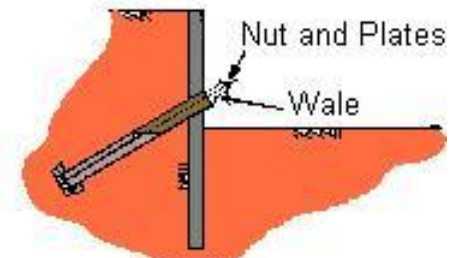
(a)



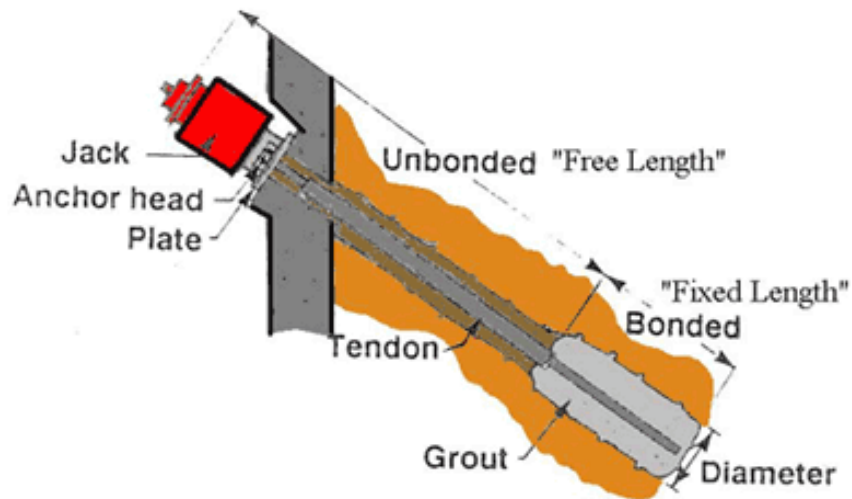
(b)



(c)



(d)





Installation of ground anchors

“As we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say, we know there are some things we do not know. But there are also unknown unknowns: the ones we don't know we don't know.”

Donald Rumsfeld

"Foot in Mouth" Award Winner 2003

Discussion

Comment on the potential causes of failure of a diaphragm basement wall system.

