

# 5. Structure: Shallow Foundations + Geotechnical Investigation

Allen and Lane  
p. 37-38, p56-71 | Ching 3.02-3.26

Foundation - transfer structural loads to the ground, spread the load into the earth

## Foundation Requirements

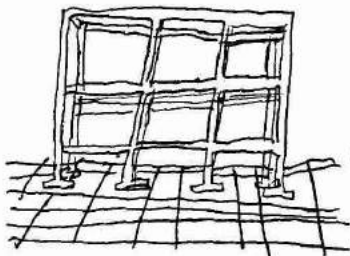
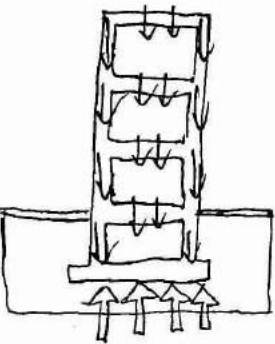
Dead load - combine all the weights inside the building, including structural elements, foundation and mechanical equipment

- Rain and snow loads - (act downward on building roofs)

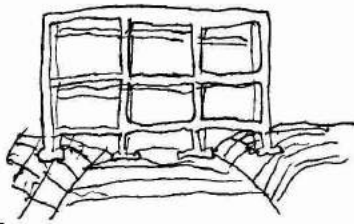
- Wind load - sideways, downward or upward on building

- Seismic loads - motion of ground relative to building in an earthquake

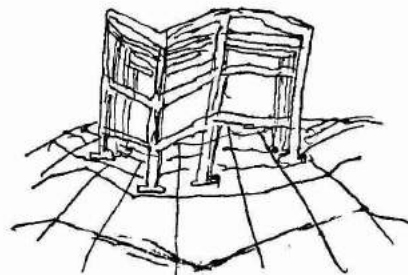
- React with equal and opposite forces



(a) Building before settlement occurs



(b) Uniform settlements



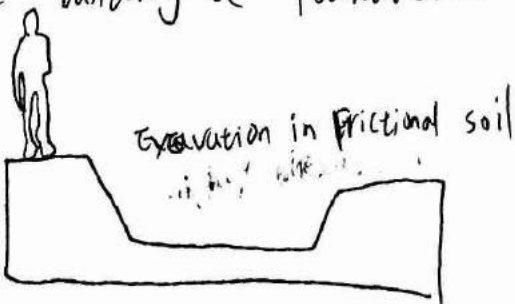
(c) Differential settlements

Uniform settlement - same rate throughout all parts of a building

Differential settlement - distortion of building frame, <sup>can lead to</sup> foundation failures

## Classifying Earth Materials

- Need drilling to take out the rock and test on the soil before building a foundation.



## Gradation

- well graded soil - well distributed range of particle sizes
- poorly graded soil - ~~consists~~ consists of particles more limited in range of sizes.
- uniformly graded material - limited, narrow size range.
- Gap graded soil - a broader range of particle sizes.

## Soils for Building Foundations

- properties determined in laboratory tests.
  - Rock and coarse is good for support a foundation
- Consolidation - a soil stratum underlies a foundation

## Site selection

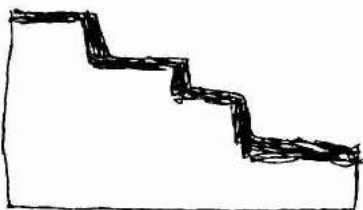
- good for transportation
- reduce pollution on air, fuel, and water
- building on a damaged <sup>foundation</sup> or ~~a foundation~~ <sup>a foundation that</sup> has used before, to save more material, ~~and~~ money and time.

## Construction process

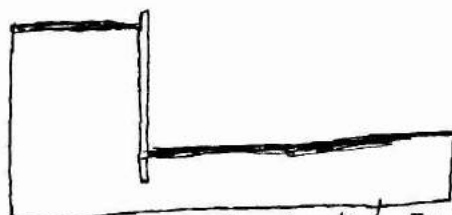
- protection of topsoil and subsoil
- able to plant trees or other vegetation
- prevent pollution

## Excavation.

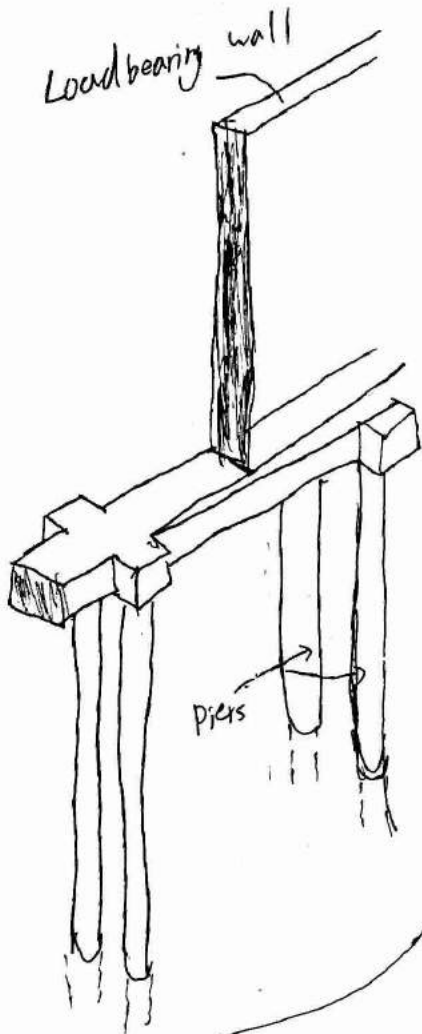
- Remove native soil
- cost a lot of money if the height for excavation is deep.



Section through Banded EXCAVATION



section through sheeted EXCAVATION

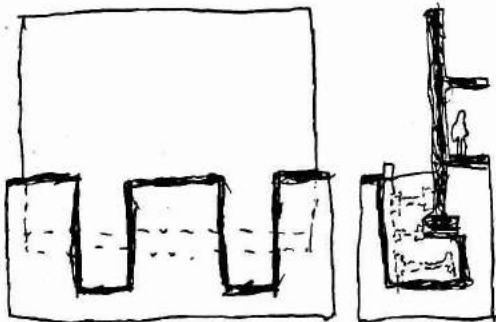


- pie caps are join by grade beam to support loadbearing wall.

- steel piles - H section or pipes (diameters of 8 to 24 inches)

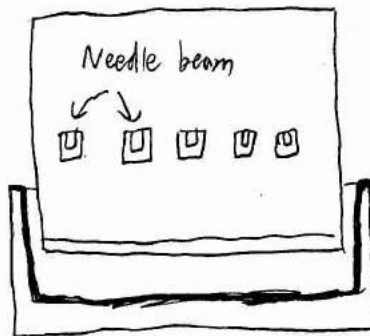
Underpinning - made existing foundation more stable

Up-Down construction - spent more money to make the construction progress faster

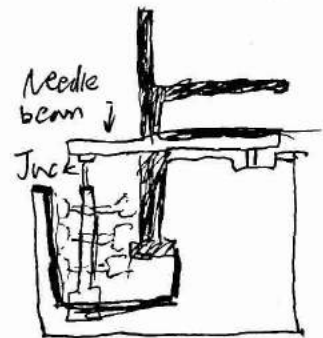


A. Elevation

Section



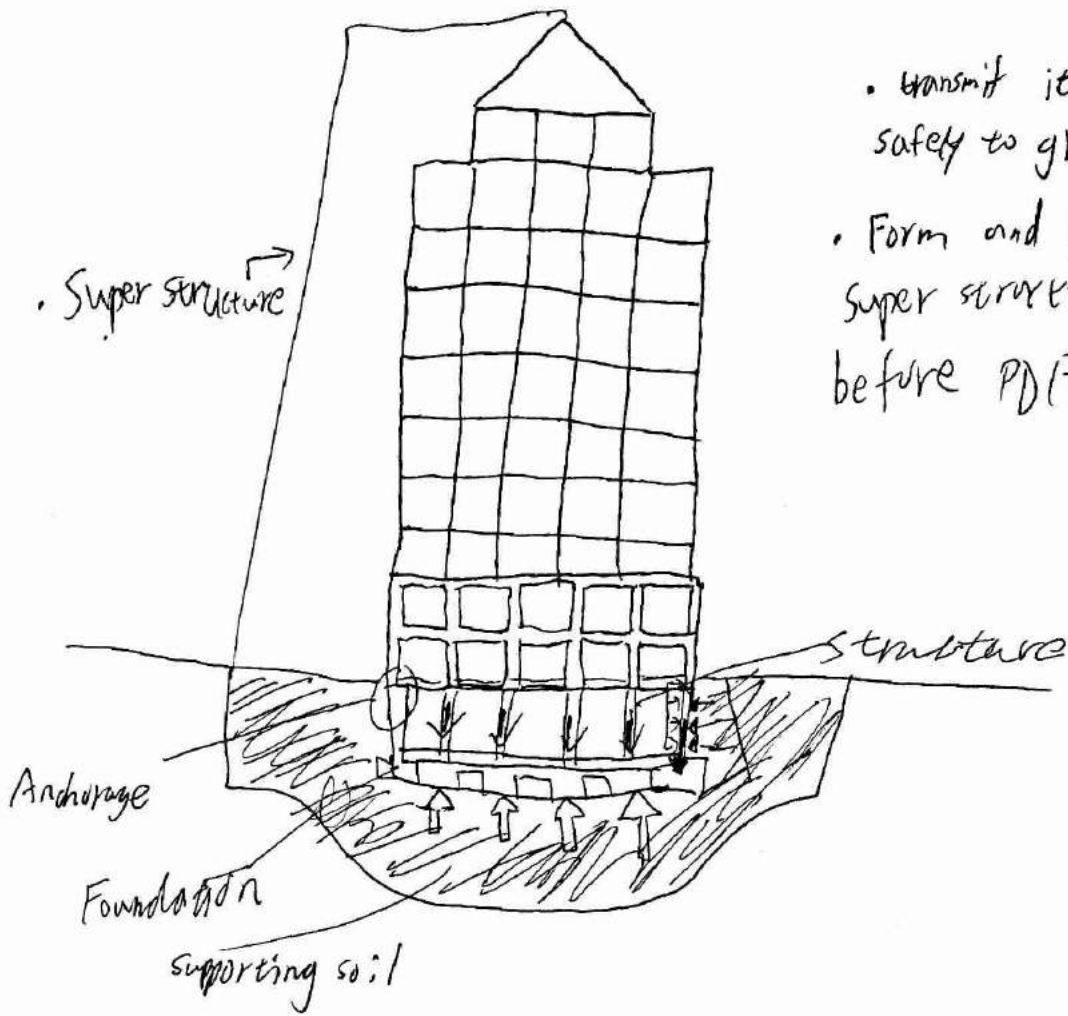
B. Elevation



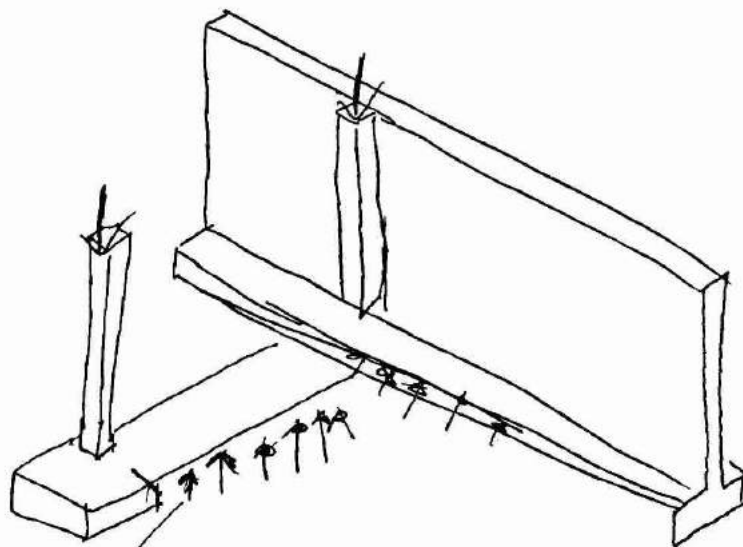
Section

Methods to support a building while carrying out underpinning work

# Foundation Systems



- transmit its loads safely to ground
- Form and layer of super structure can be pre-processed



Transmit equal load to the supporting soil or rock

## Types of Foundation systems

- Shallow Foundation - place on lower part of ~~structure~~ Substructure and transfer building loads to supporting soil

- Deep Foundations - it's apply when the soil underlying a foundation is unstable. Need to get deeper to more appropriate bearing stratum to transfer building loads.

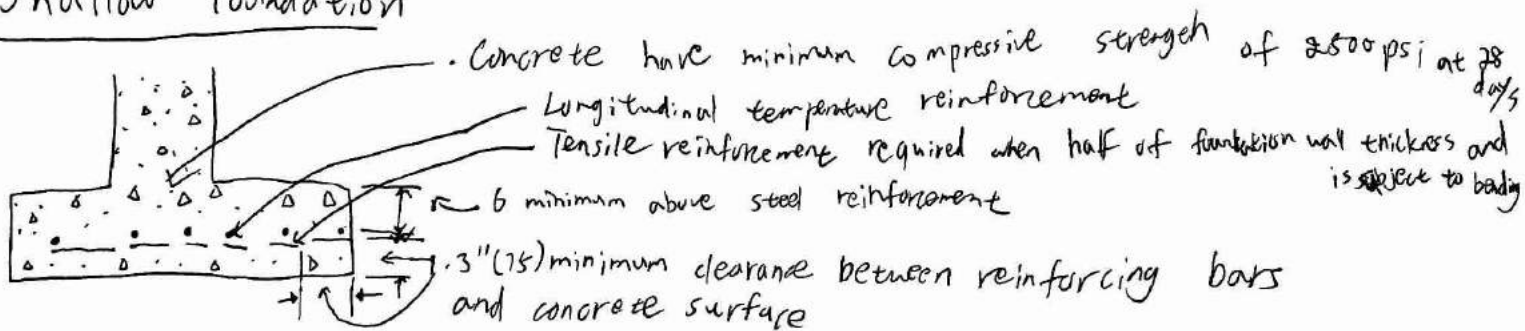
Important factors for select and design the type of foundation system

- Topography of the site
- construction method, cost and risk
- subsurface and groundwater conditions
- Building code requirements

## Excavation Support Systems

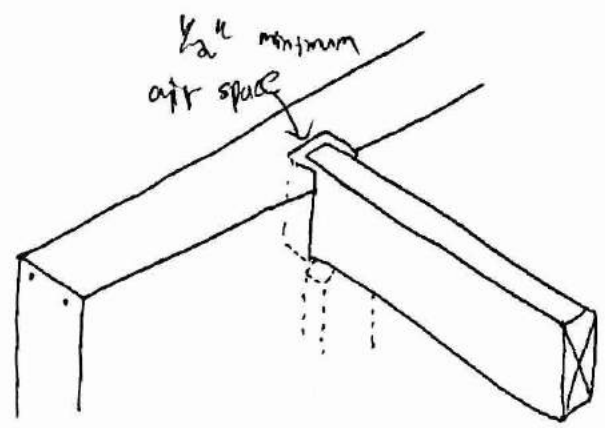
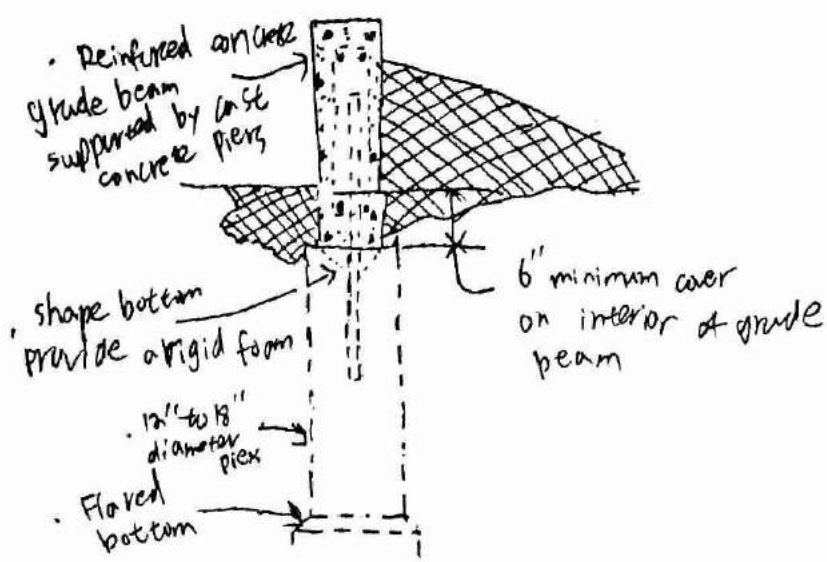
- slurry wall - concrete wall cast in trench
- Dewatering - prevent excavation from filling with groundwater.

## Shallow Foundation



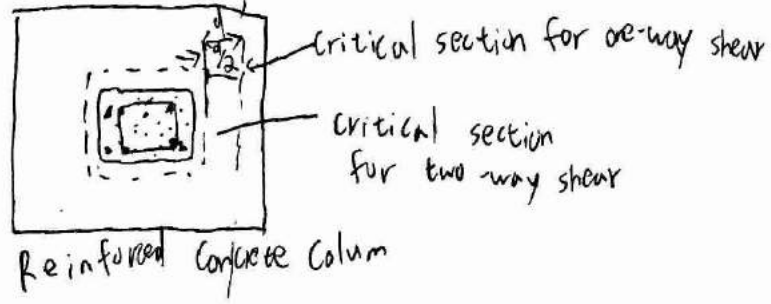
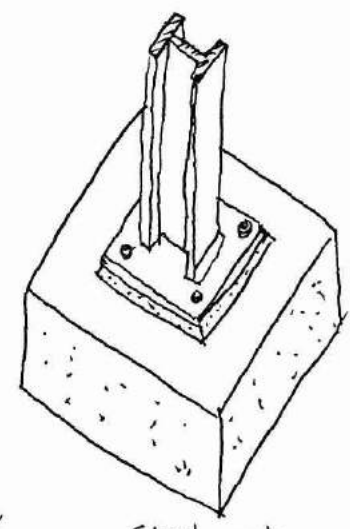
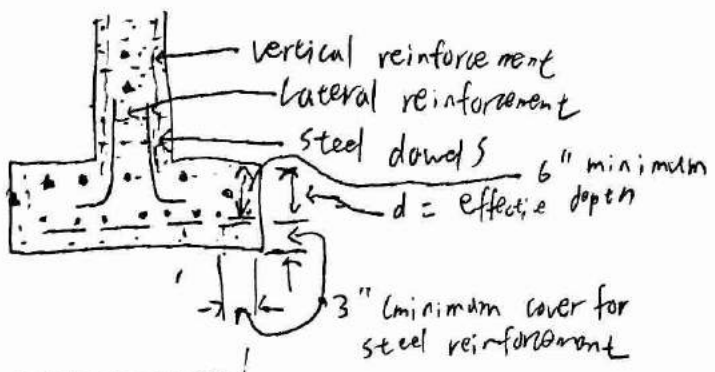
## Foundation walls

- provide support for superstructure
- must resist active earth pressure and anchor the superstructure against wind
- size of footing is based on foundation wall load

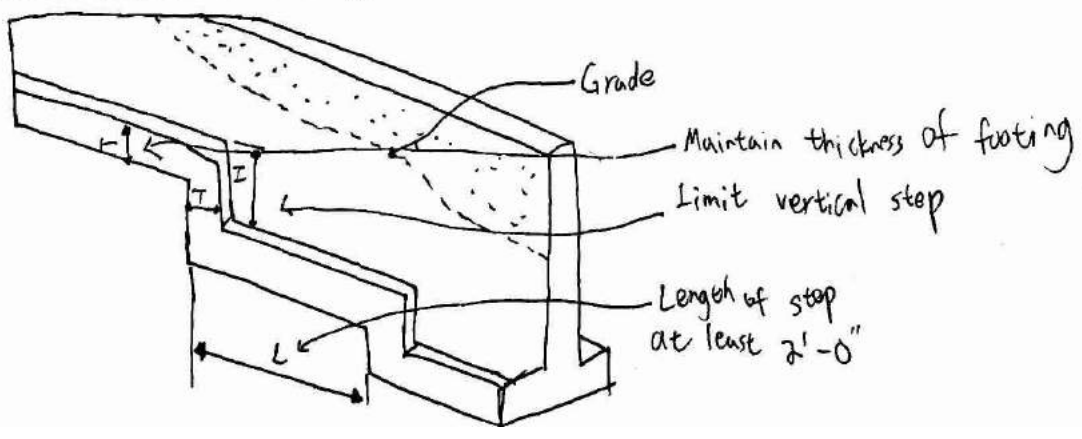


Wood Beams

## Column Footings



## Foundation on sloping Ground



# Concrete Slabs on Grade

- Combined floor and foundation system
- require support of level, stable, properly <sup>compacted</sup> soil base

Maximum slab  
Dimension  
Feet (M)

Up to 45 (14)
45-60 (14-18)
60-75 (18-23)

