

THEORY & DESIGN OF STRUCTURES IV



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INTRODUCTION**N** **T**O **F**OUNDATION**N** **S**YSTEMS**S**

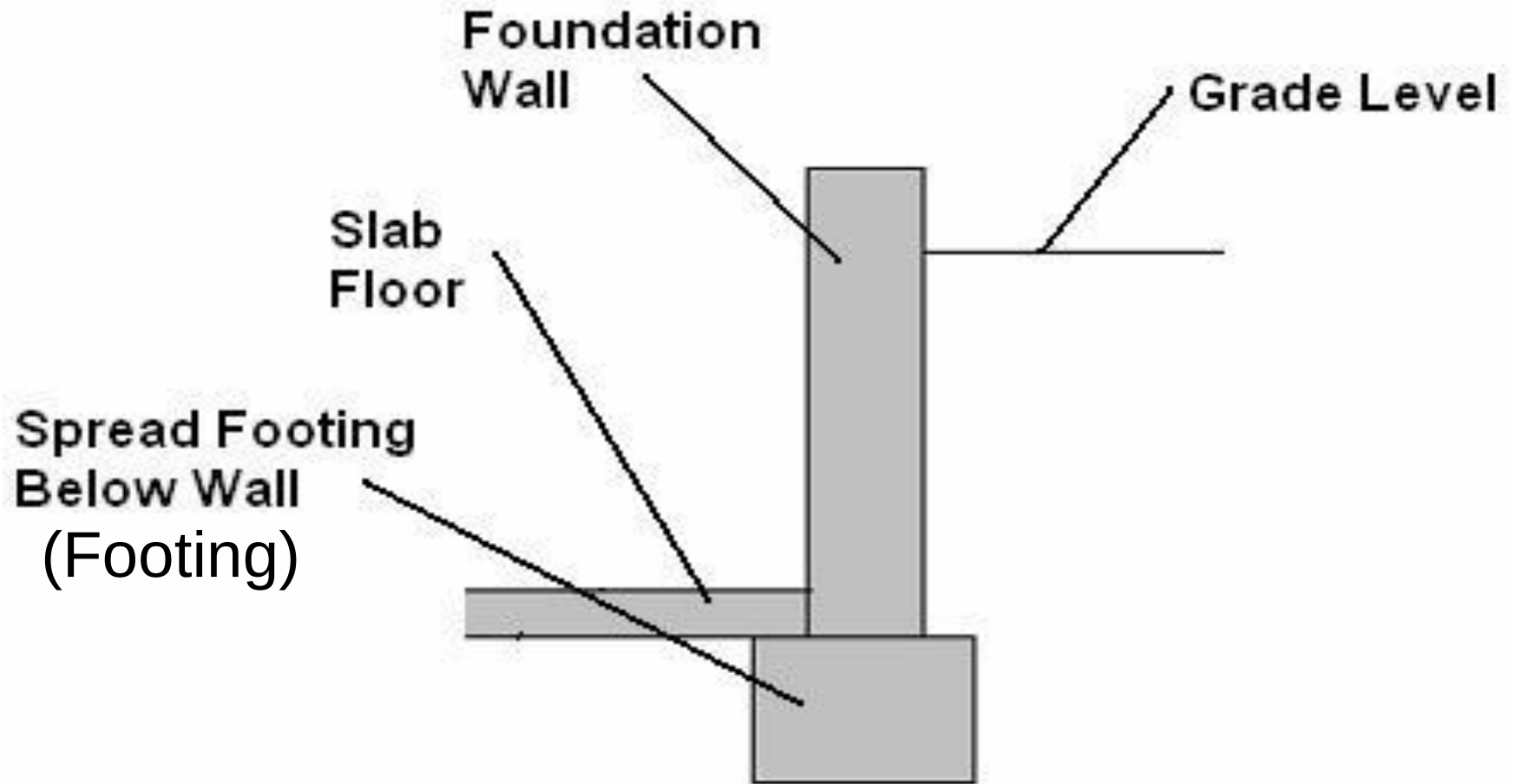


INTRODUCTION

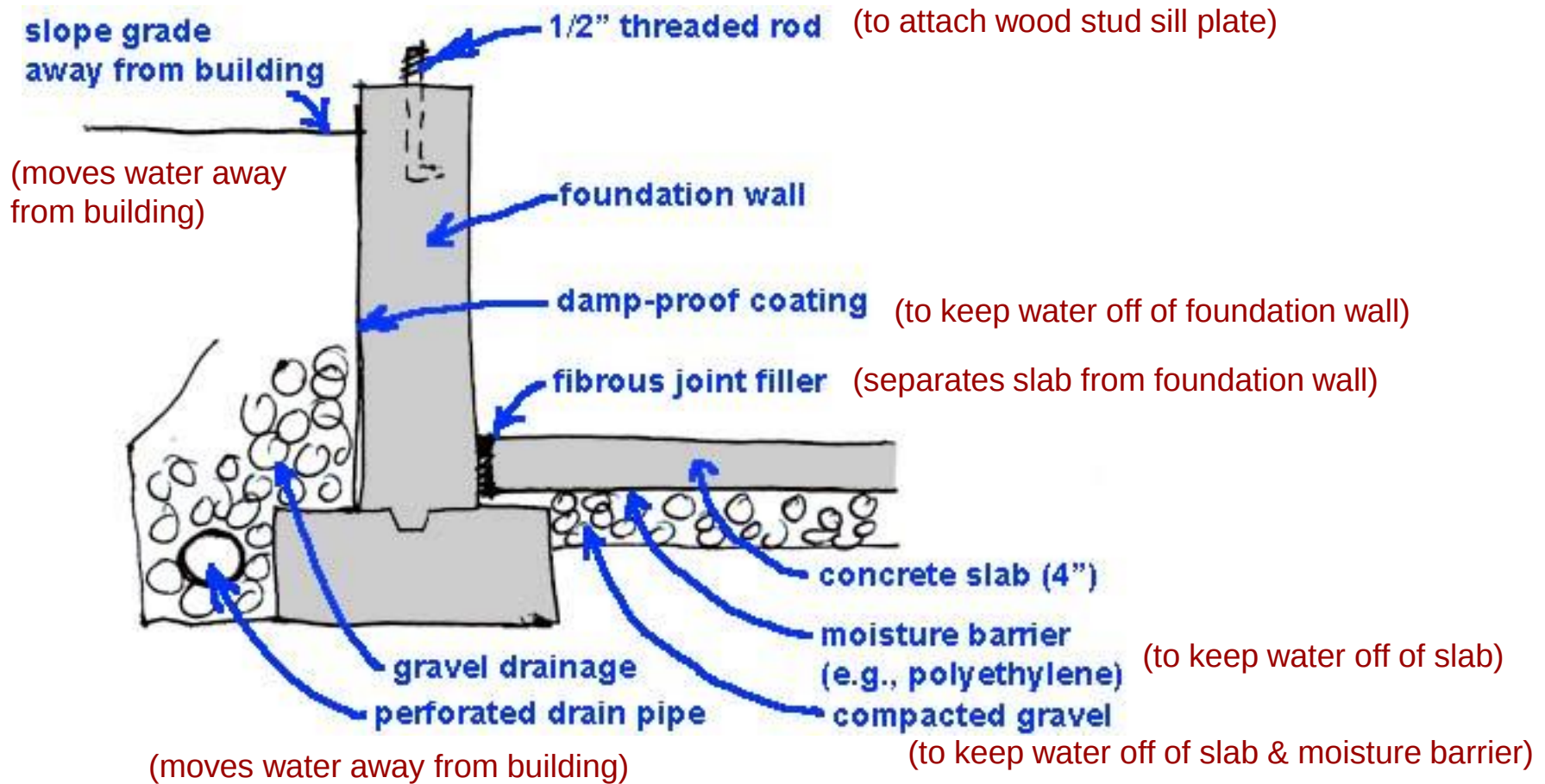
RECAP

- Function of a foundation is to transfer the structural loads from a building safely into the ground.
- A larger and heavier building of masonry, steel, or concrete would require its foundations to go deeper into earth such that the soil or the rock on which it is founded is competent to carry its massive loads.

FOUNDATION COMPONENTS

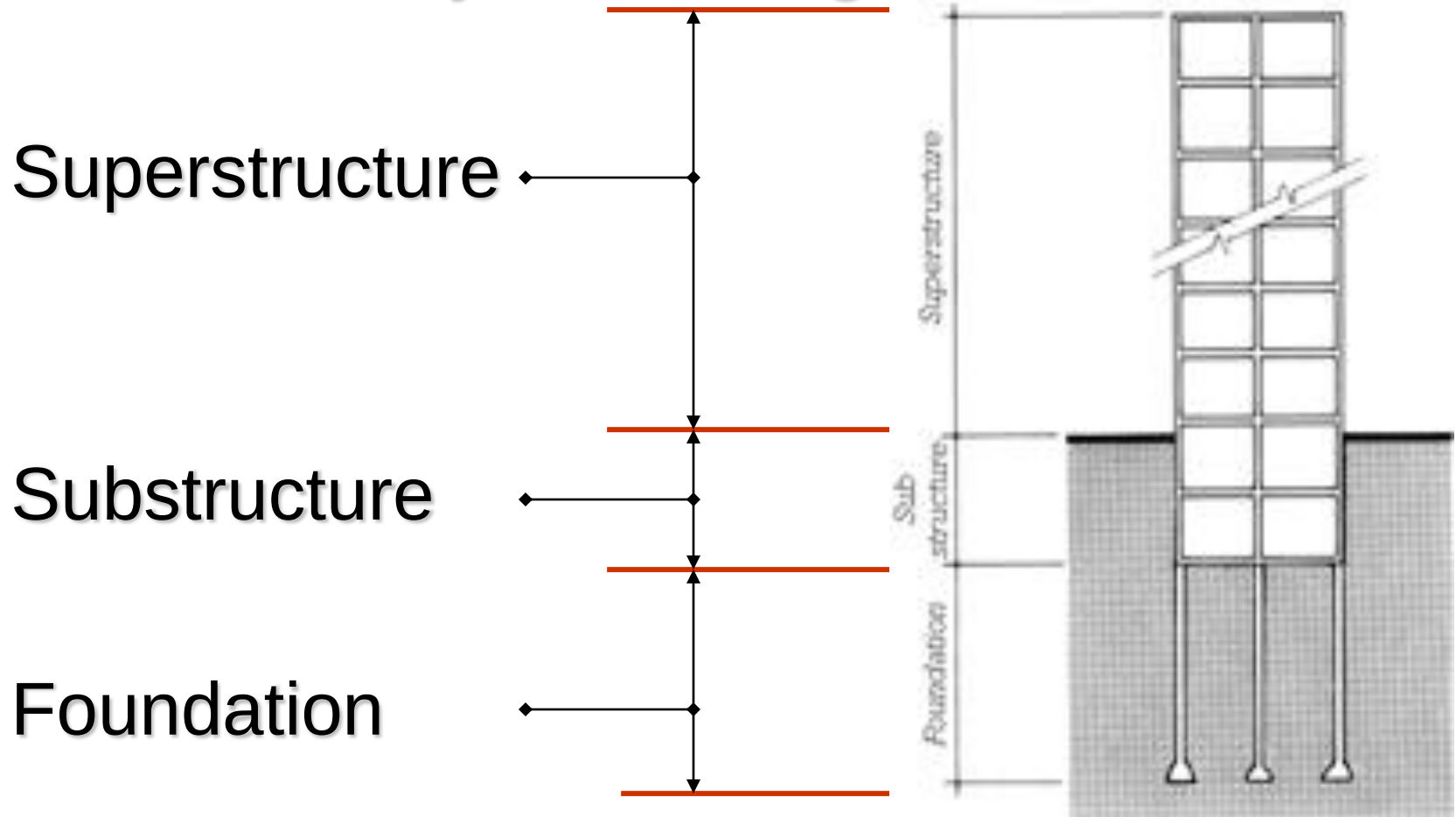


FOUNDATION COMPONENTS



TYPES OF FOUNDATION

Major Building Parts



TYPES OF FOUNDATION

Two types foundations : Shallow and Deep –

Depends on whether the **load transfer** is at deeper depths or shallower depths

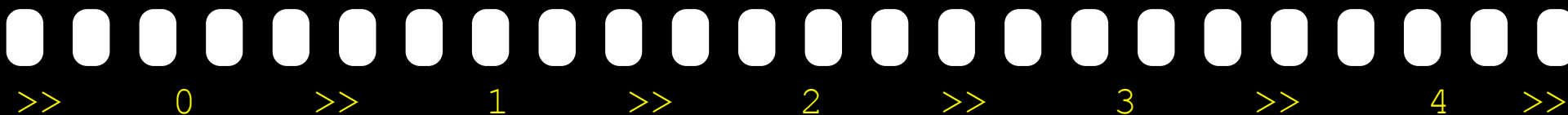
- Need for these two types (soil strength, ground water conditions, foundation loads, construction methods and impact on adjacent property)

TYPES OF FOUNDATION

- **SHALLOW FOUNDATIONS**
 - INDIVIDUAL FOOTINGS
 - STRIP FOOTINGS
 - RAFT OR MAT FOUNDATIONS

- **DEEP FOUNDATIONS**
 - **PILE FOUNDATIONS**

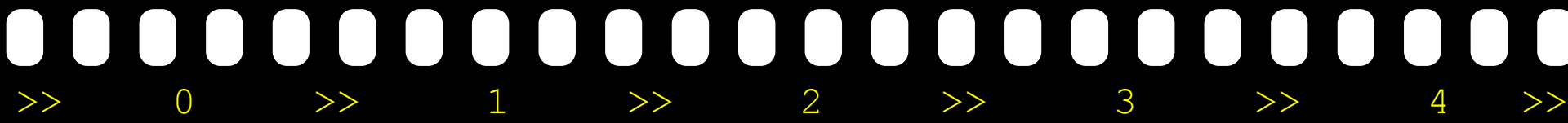
1.) End Bearing Piles 2.) Friction Piles



TYPES OF FOUNDATION

Shallow foundations (column footings without or with tie/grade beams, individual or combined wall footing, slab on grade, raft)

- Deep foundations (caissons with or without sockets, end bearing or friction piles, pile groups), made of concrete (regular or site-cast) or steel or wood



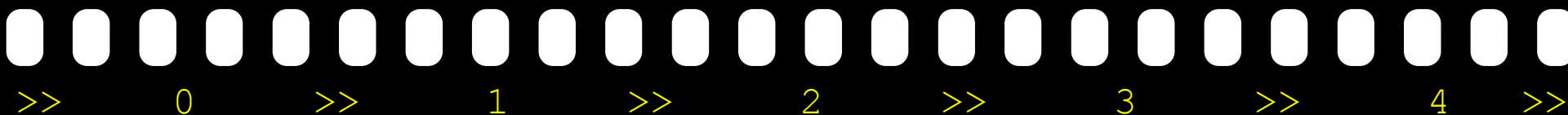
SHALLOW FOUNDATIONS

- Requirements

- Suitable soil bearing capacity
- Undisturbed soil or engineered fill

- Basic types or configurations

- Column footings
- Wall or strip footings

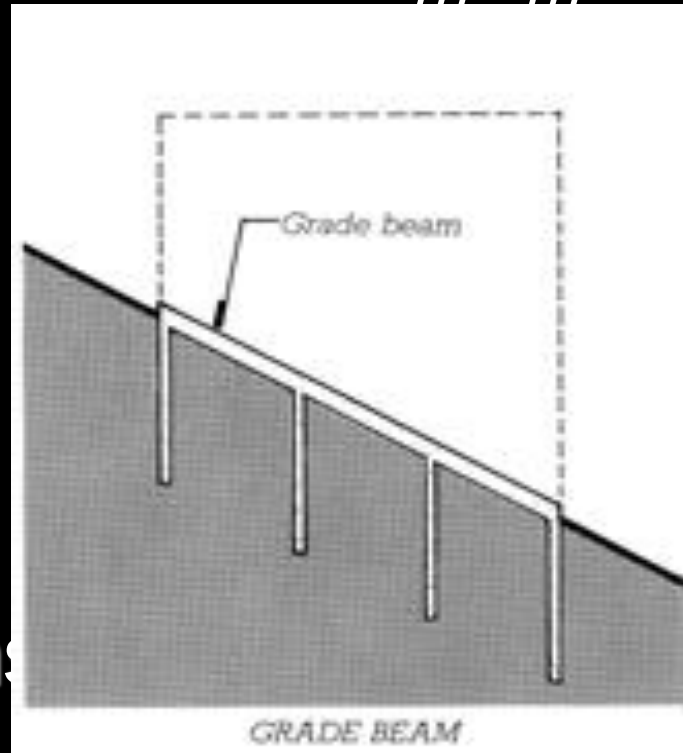


Combination Spread & Strip Footing

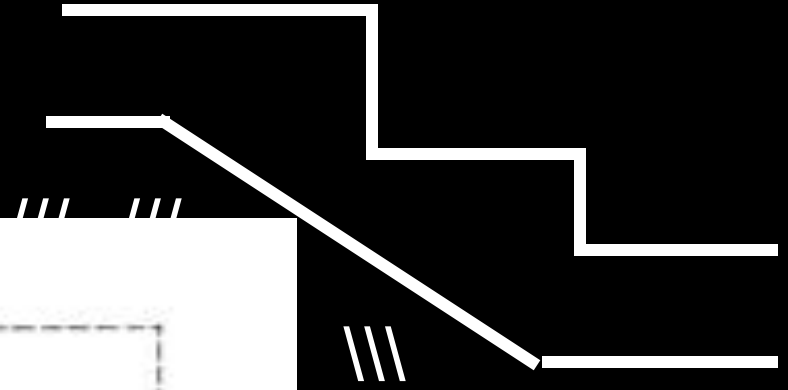


SHALLOW FOUNDATIONS

Stepped strip footings



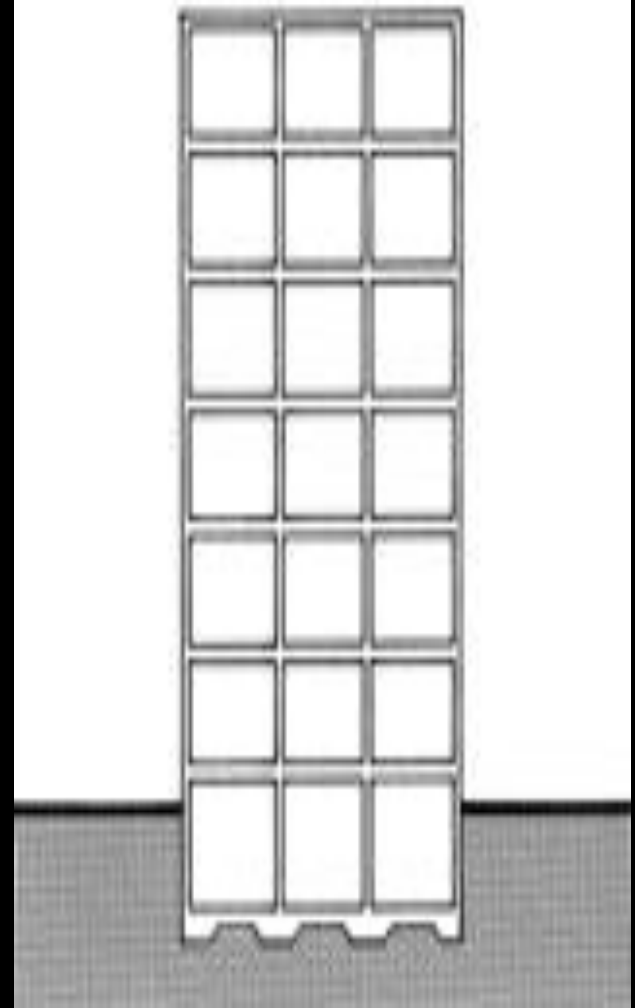
Grade Beams



SHALLOW FOUNDATIONS

→ Mat foundation

→ Floating (Mat)
foundation



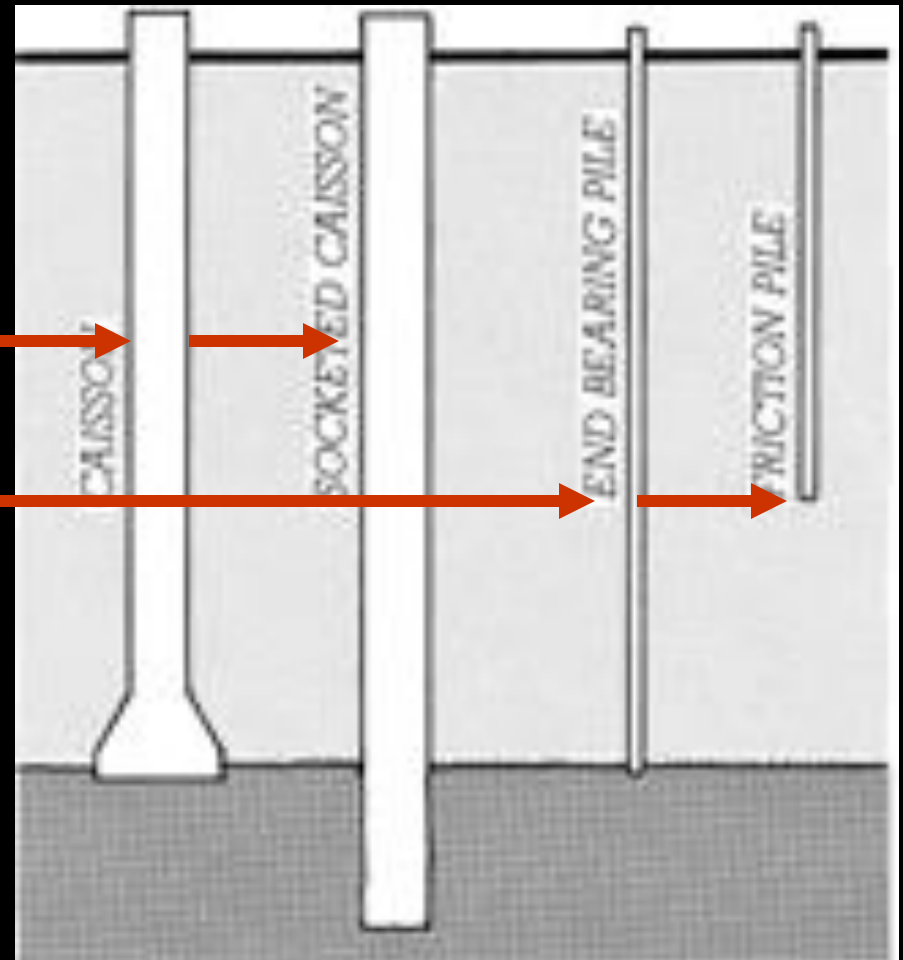
Deep Foundations – Purpose

Transfer building loads deep into the earth

Basic types

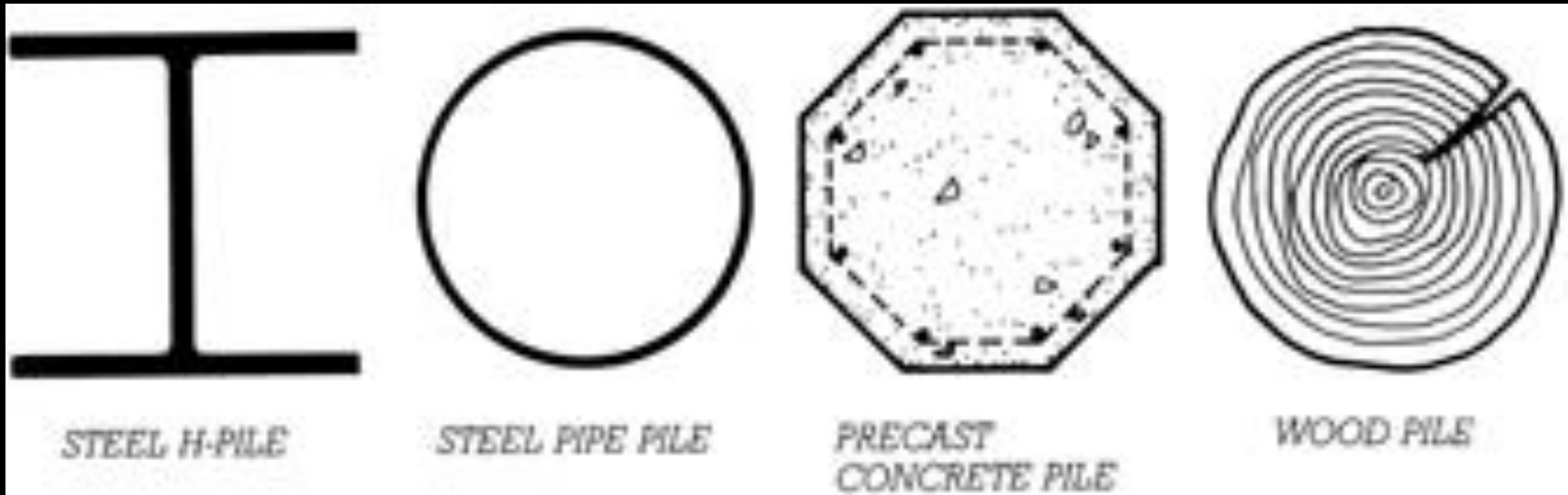
- Drilled (& poured)

- Driven

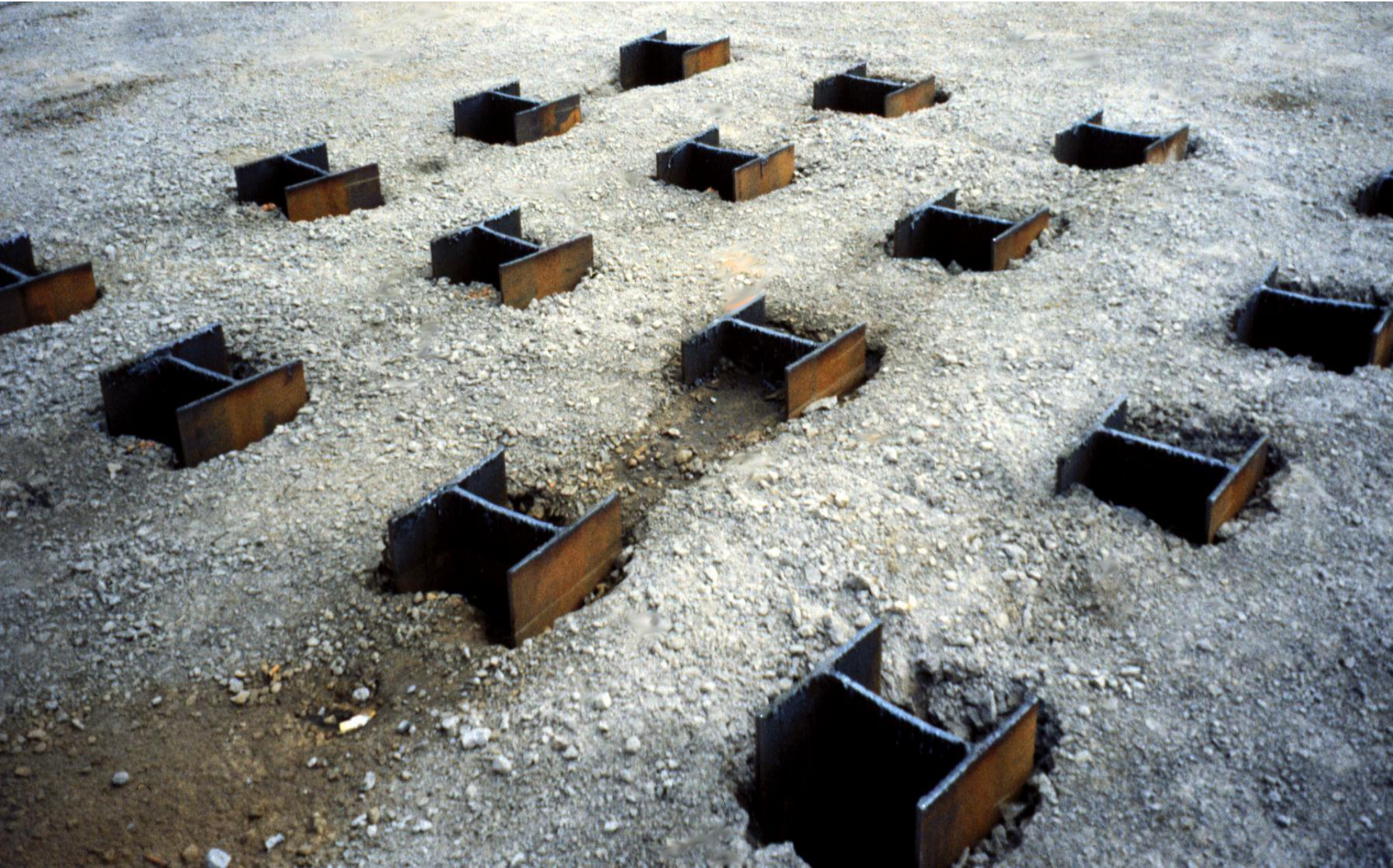


PILE MATERIAL

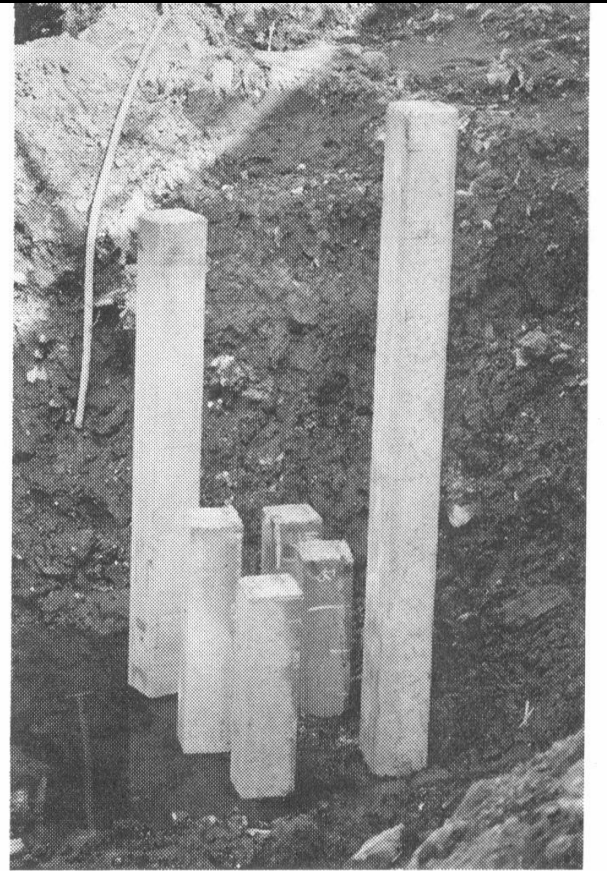
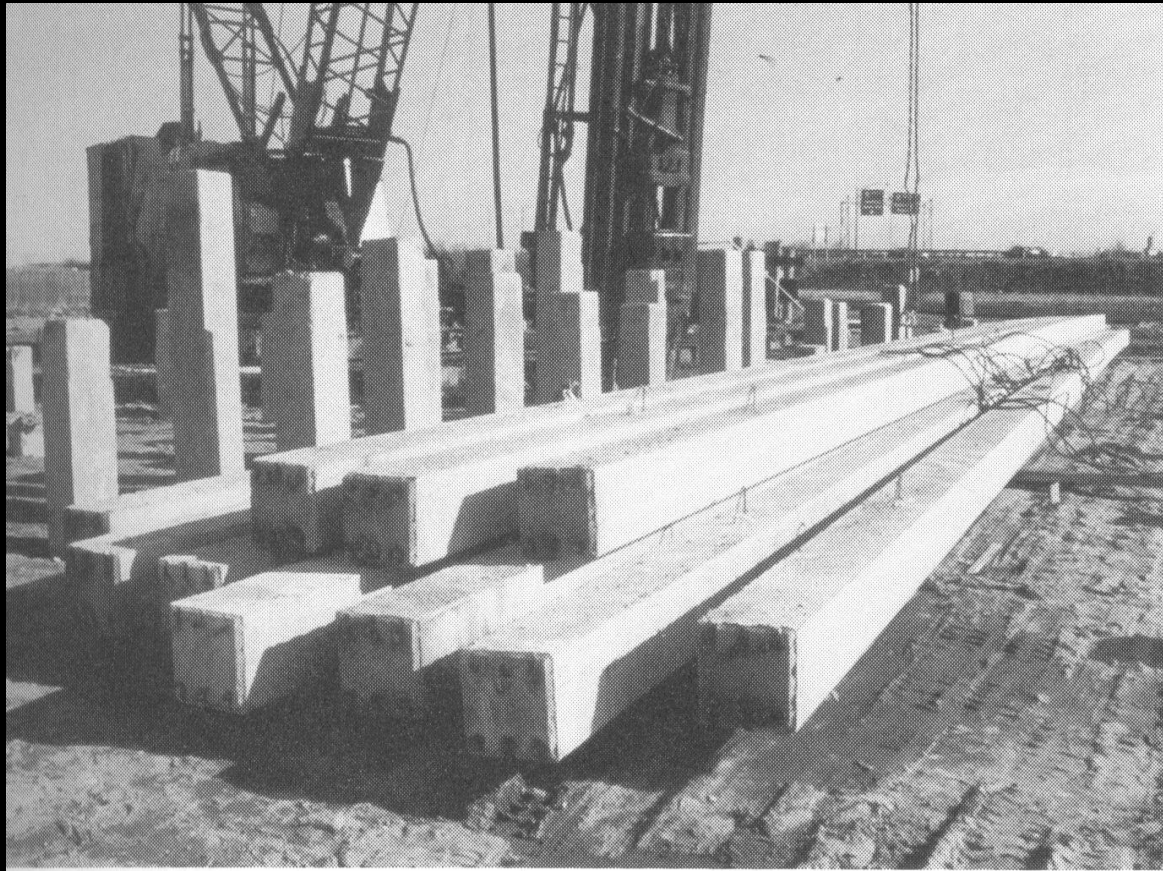
- Steel; H- piles, Steel pipe
- Concrete; Site cast or Precast
- Wood; Timber
- Composite



DRIVEN PILES



PRECAST CONCRETE PLIES



RAFT FOUNDATION

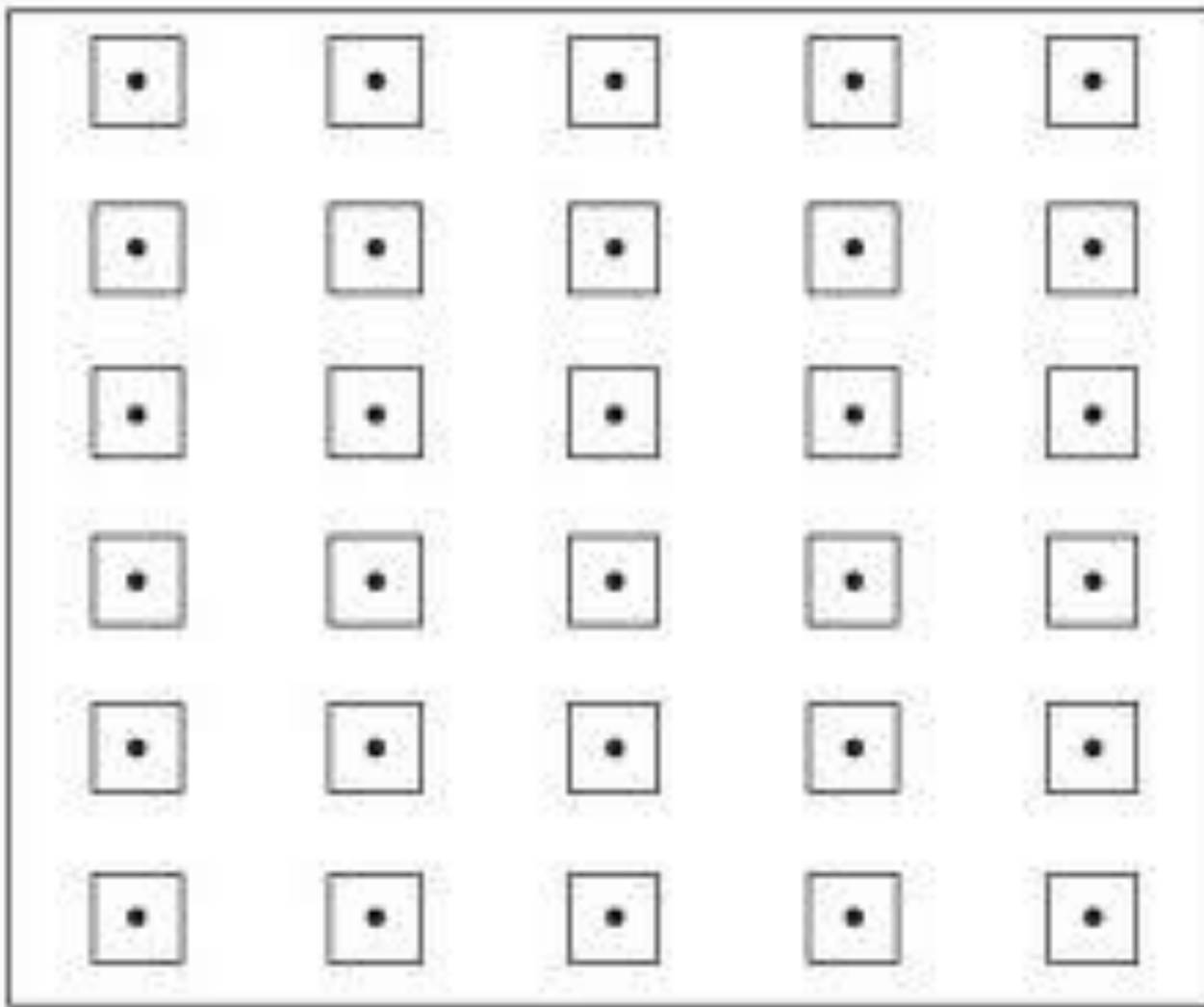
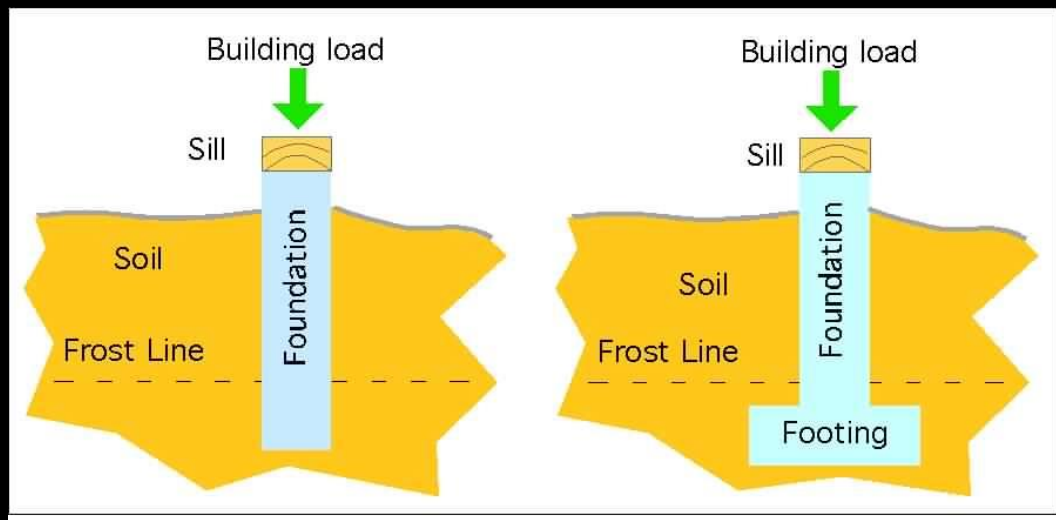


Fig. 7.6. Raft foundation

FOUNDATION SYSTEMS



LOADS

➤ Types of loads

1. Dead Load

2. Live Load

3. Wind Load



Building Loads

4. Horizontal Pressures Below Grade

5. Forces (Uplift)

6. Earthquake

HORIZONTAL PRESSURE

- Soil presses against foundations.
 - Sometimes called lateral pressure.
- Factors which influence pressure:
 - Type of soil surrounding the foundation.
 - Course well drained soils = low pressure
 - Silt and clay = higher pressure (especially when wet)
 - The water content of the soil.
 - Water in soil causes hydrostatic pressure.
 - Wet silt = 50% increase in pressure
 - Wet clay = 3 times the pressure
 - Excess water must be drained away to prevent excessive hydrostatic pressure.
 - The difference in soil height between opposite sides of the foundation.
 - Soil creep
 - Problem with structures built on side slopes.

UPLIFT FORCES

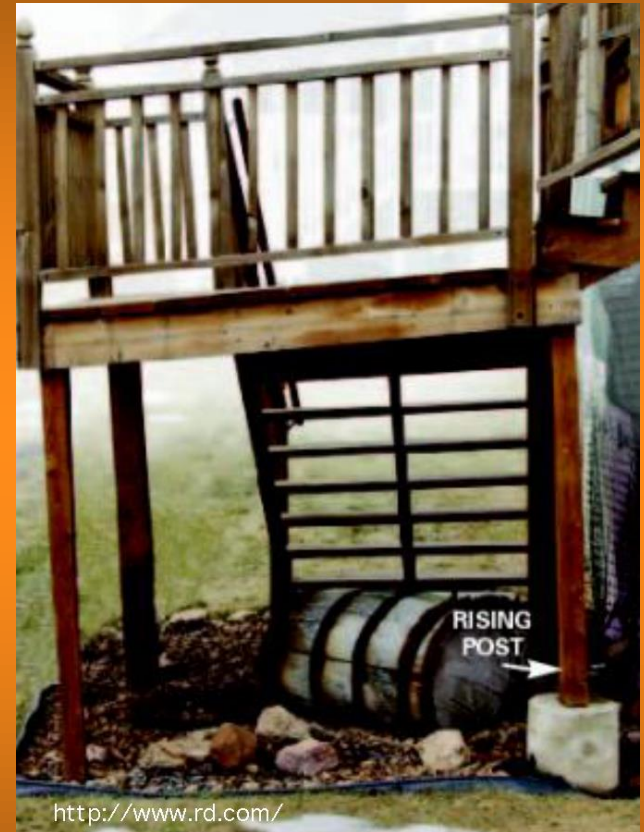
- Uplift forces tend to pull or push the foundation out of the ground.
- The primary pulling force is wind acting on the building.
 - The mass of the foundation is usually sufficient to withstand this force.
 - May be a problem on light airy structures with little or no foundations.

PUSH FORCES

- The primary pushing force is frost heave.
 - Can be a serious problem
- Some building codes allow footings above the frost line, but they must be insulated according to building code.

How do you prevent frost heave?

- Insure foundation or footing is below frost line.
 - ❖ Depth varies with clement.
 - ❖ Stillwater = 18 to 24 inches



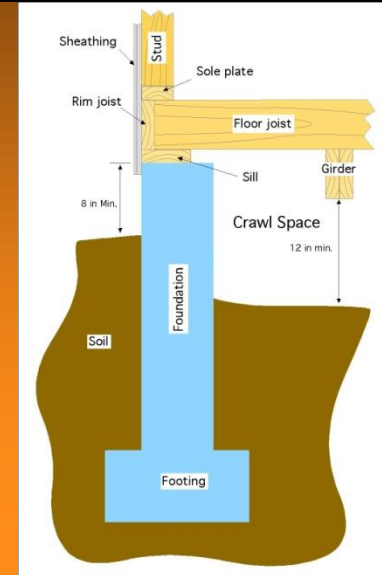
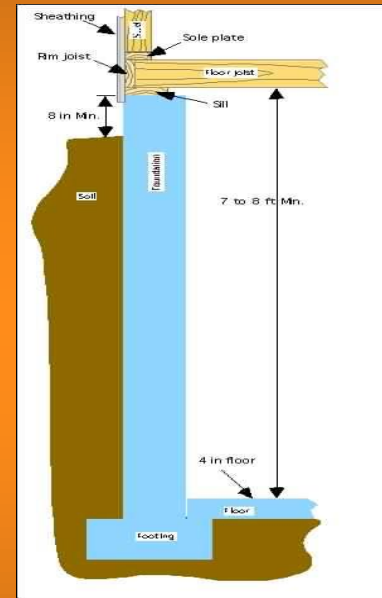
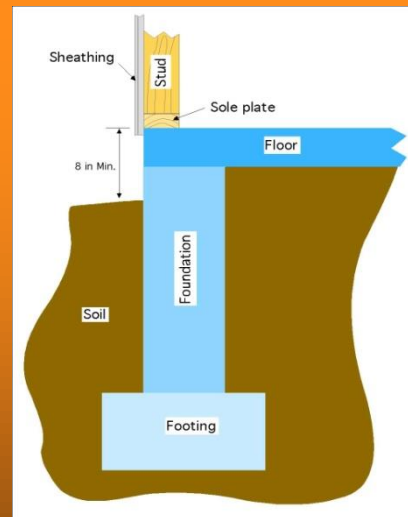
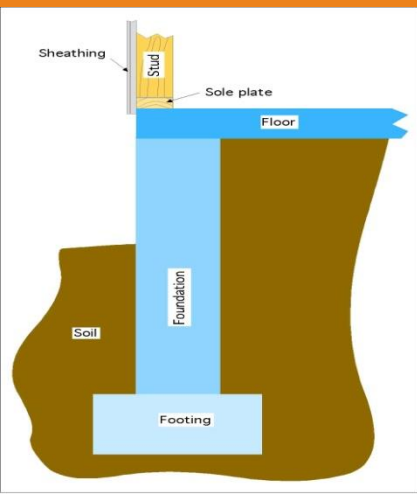
EARTHQUAKES

- Earthquakes cause unique forces and intensify the results of normal forces.
- Ground failure changes the characteristics of the surface beneath a structure during an earthquake.



FOUNDATION SYSTEMS

- Four main types of foundation systems.
 - Crawl space
 - Full basement
 - Slab at grade
 - Elevated slab



FOUNDATION REQUIREMENTS

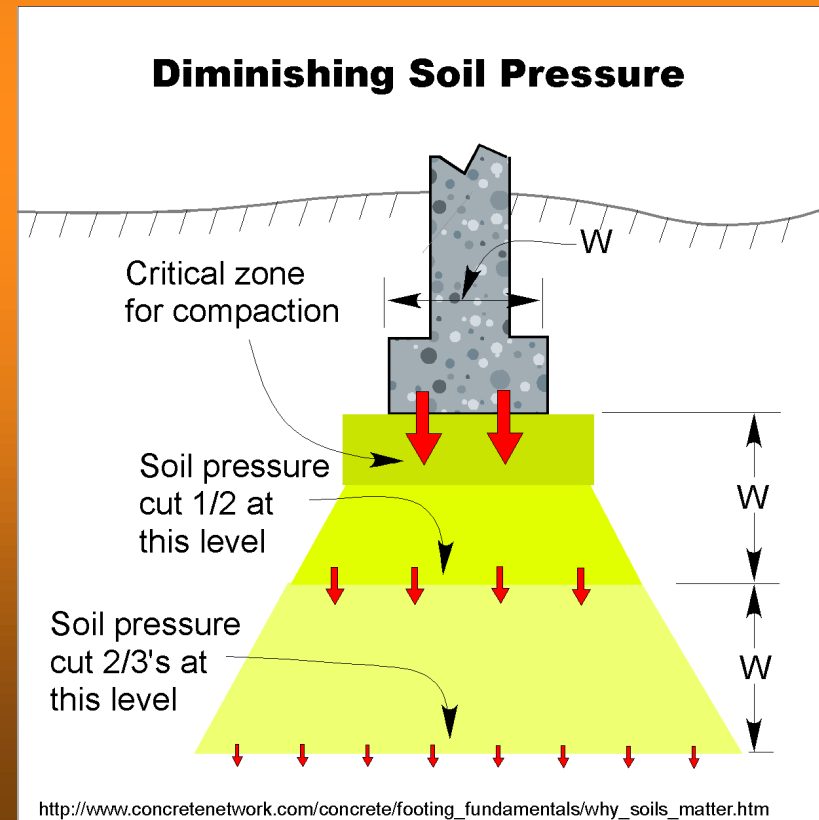
Three primary foundation requirements:

- Safe against Structural Failure
- Not Impairing Function of Building
- Technically & Economically Feasible



FOOTINGS

- The job of the footing is to **transfer the weight** of the building to the soil and provide a **level platform** for the foundation.
- Building load diminishes with depth.
- An additional concern is the location of the foundation wall on the footing.
 - Must be centered



FOOTINGS-cont.

- Footing size is determined by the weight of the building and the load bearing characteristics of the soil.

Minimum Width of Concrete or Masonry Footings (inches)						
	Load-Bearing Value of Soil (psf)					
	1,500	2,000	2,500	3,000	3,500	4,000
Conventional Wood Frame Construction						
1-story	16	12	10	8	7	6
2-story	19	15	12	10	8	7
3-story	22	17	14	11	10	9
4-Inch Brick Veneer Over Wood Frame or 8-Inch Hollow Concrete Masonry						
1-story	19	15	12	10	8	7
2-story	25	19	15	13	11	10
3-story	31	23	19	16	13	12
8-Inch Solid or Fully Grouted Masonry						
1-story	22	17	13	11	10	9
2-story	31	23	19	16	13	12
3-story	40	30	24	20	17	15
http://www.concretenetwork.com/concrete/footing_fundamentals/footing_dimensions.htm						

ADDITIONAL INFORMATION

http://www.concretenetwork.com/concrete/footing_fundamentals/

<http://www.understandconstruction.com/introduction-to-foundations.html>

<http://www.aboutcivil.org/foundation-types-construction-methods.html>

PowerPlugs

Templates for PowerPoint



