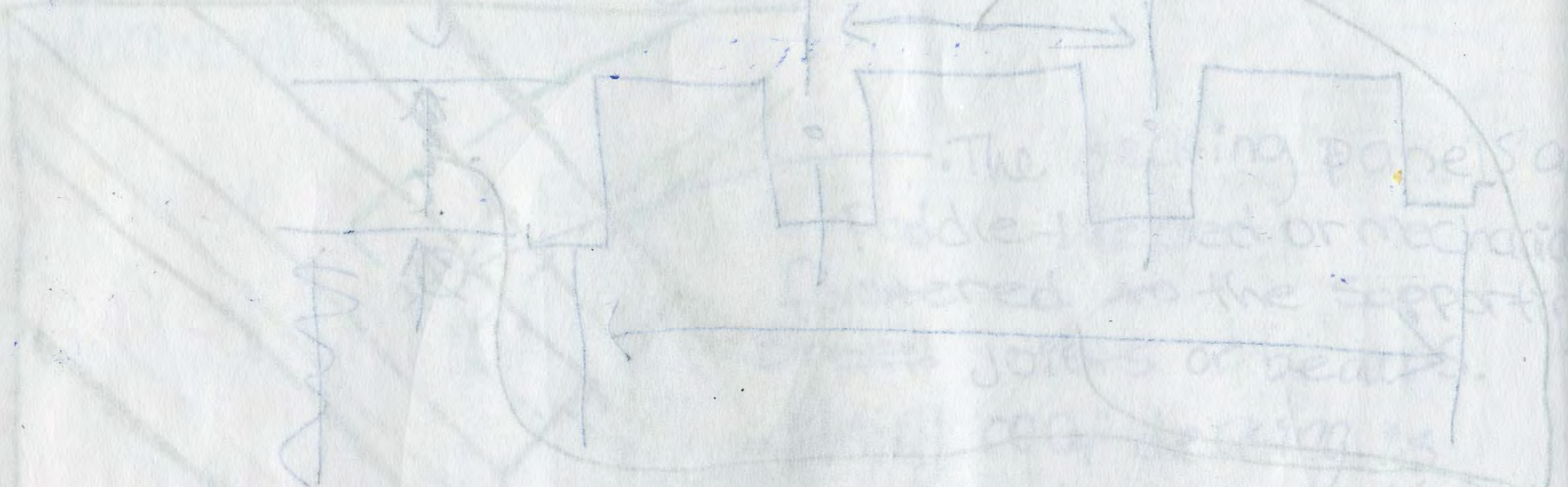


Metal Roof Decking



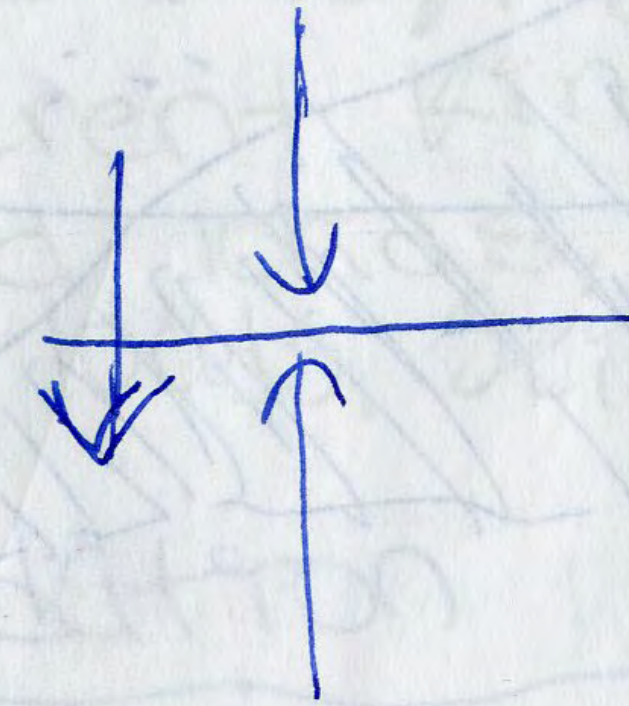
Metal Roof Decking

Structure: Shallow Foundations + Geotechnical Investigation.

Bedrock →

~~DIET~~

Settlement -  
the building  
is settling



equal and opposite source.  
You will get movement.

PSI - Pound Per Square Inch

Geotechnical Investigation - Engineer expert studying to obtain information on the physical properties of soil and rock around a site to design earthworks and foundations for proposed structures and for repair of distress to earthworks and structures caused by subsurface conditions.

Spread the load into the earth.

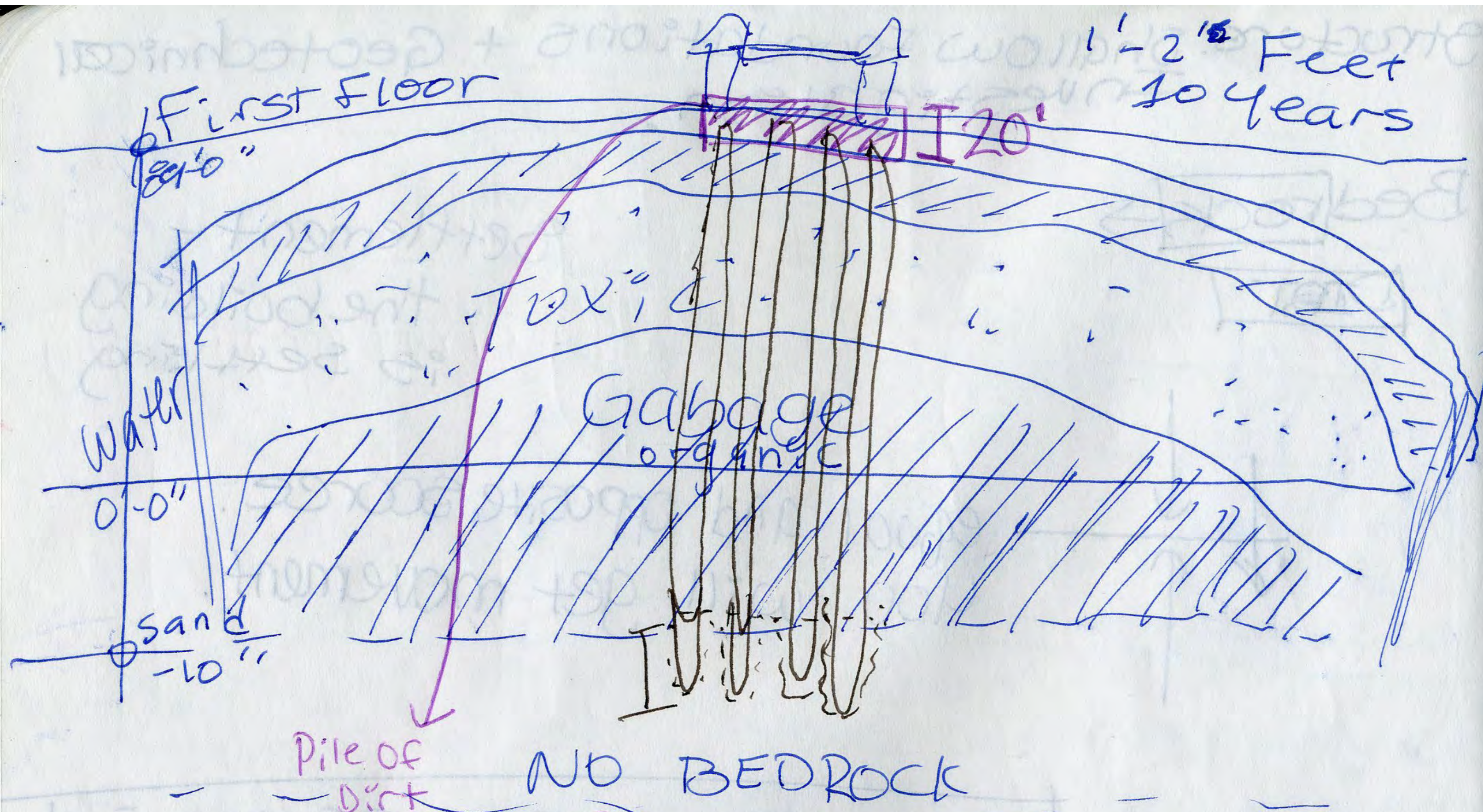
Ribbed Roof Decking

8" (205)

3" and 4-1/2" (75 and 115)

depth 50 and 100

12" 24" (305, 610)



The function of a foundation is to transfer the structural loads reliably from a building into the ground.

### Foundation Requirements

- **Dead loads**: A building foundation must support different kinds of loads:
- Dead loads, Live loads, Rain and snow loads, wind loads, seismic loads.

### Foundation Settlement

All foundations settle to some extent as the earth materials around and beneath them adjust to the loads of the building.

Bedrock is stable and can support a huge amount of loads.

**Frost line** - The maximum depth of ground below which the soil does not freeze in winter.

**Tiebacks** - A decorative strip of fabric or cord, typically used for holding an open curtain ~~near~~ off to the side of the window.

Three General requirements foundations must meet.

1. Most be safe against structural failure that could result in collapse.
2. Most not settle during life of building in such a way that would damage structure or impair function.
3. Most be feasible, economical, & practical (with no impact on neighbors.)

waterproofed foundations. Footing drains.

## Earth Materials

### Classifying Earth Materials

Earth materials are classified according to particle size, the presence of organic content, and in the case of finer grained soils, ~~and~~ sensitivity to moisture content.

• **Rock**: A continuous mass of solid mineral material, such as granite or limestone.

• **soil**: A general term referring to any earth material that is particulate.

If an individual particle of soil is too large to lift by hand or requires two hands to lift, it is a boulder.

**Cobble**: When it takes the whole hand to lift a particle.

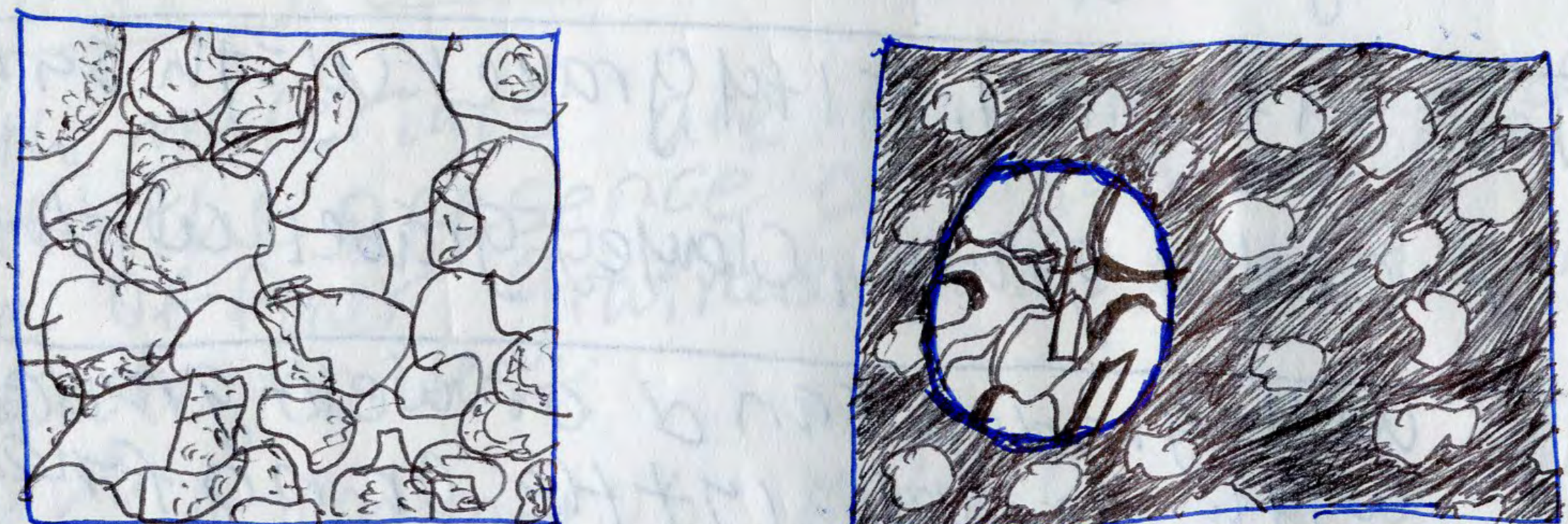
**Gravel**: When a particle can be lifted easily between thumb and forefinger.

Individual silt particles are too small to be seen with the unaided eye and range in size from 0.003 to 0.0002 inch (0.075-0.005 mm).

Clay particles are plate-shaped rather than spherical.

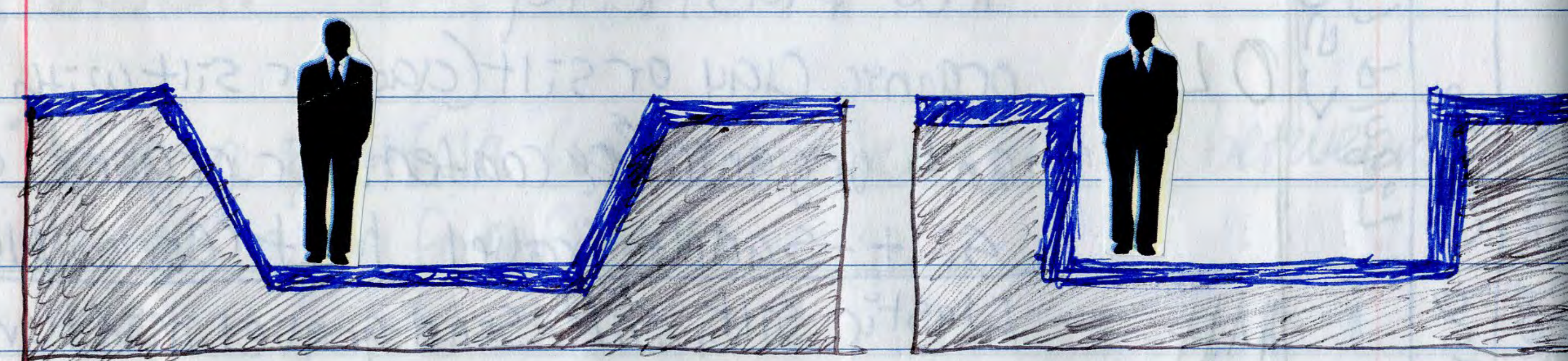
Group Symbol	Descriptive Names of Soil within This Group	Coarse-Grained Soils	
		Gravels	Sands
GW	Well-graded gravel or well-graded gravel with sand, little or no fines	Clean Gravels	Clean Sands
GP	Poorly graded gravel or poorly graded gravel with sand, little or no fines	Gravels with Fines	Clean Sands
GM	Silty gravel, silty gravel with sand	Gravels with Fines	Sands with Fines
GC	Clayey gravel, clayey gravel with sand	Gravels with Fines	Sands with Fines
SW	Well-graded sand or well-graded sand with gravel, little or no fines	Clean Sands	Clean Sands
SP	Poorly graded sand or poorly graded sand with gravel, little or no fines	Sands with Fines	Clean Sands
SM	Silty sand, silty sand with gravel	Sands with Fines	Sands with Fines
SC	Clayey sand, clayey sand with gravel	Sands with Fines	Sands with Fines
ML	Silt or silt-sand-gravel mixtures, low plasticity	Fine-grained Soils and Clays Liquid Limit < 50 Plasticity Limit = 50	
CL	Lean clay or clay-sand-gravel mixtures, low plasticity		
OL	Organic clay or silt (clay or silt with significant organic content), or organic clay- or silt-sand-gravel mixtures, low plasticity		
MH	Elastic silt, silt-sand-gravel mixtures		
CH	Fat clay or clay-sand-gravel mixtures, high plasticity	Highly Organic Soils Liquid Limit > 50 Plasticity Limit > 50	
OH	Organic clay or silt (clay or silt with significant organic content), or organic clay- or silt-sand-gravel mixtures, high plasticity		
PT	Peat, muck, and other highly organic soils.		

The unified soil classification system, from ASTM D 2487. The group symbols are a universal set of abbreviations for soil types.



Silt particles (top) are approximately equidimensional granules, while clay particles (bottom) are plate-like and much smaller than silt.

(A circular area of clay particles has been magnified to make the structure easier to see.)



EXCAVATION IN FRICTIONAL SOIL      EXCAVATION IN HIGHLY COHESIVE SOIL

- Excavations in frictional and highly cohesive soils.

Table 1804.2 Allowable Foundation and lateral pressure

Class of material	Allowable Foundation pressure (psf)	Lateral Bearing (psf/ft below natural grade)	Lateral Sliding	
			Coefficient of friction	Resistance (psf)
1. Crystalline Bed rock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. sandy gravel and/or gravel (GW and GP)	3,000	200	0.35	—
4. sand, silty sand, Clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH, CH)	1,500 <sup>c</sup>	100	—	130

For SI: 1 pound per square foot = 0.0479 kPa, 1 pound per square foot per foot = 0.157 kPa/m.

- Coefficient to be multiplied by the dead load.
- Lateral sliding resistance value to be multiplied by the contact area, as limited by section 1804.3.
- Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.
- An increase of one-third is permitted when using the alternate load combinations in section 1605.3.2 that include wind or earthquake loads.

Peat, topsoil, and other organic soils are not suitable for the support of building foundations.

### Properties of soils

The ability of a coarse-grained soil (gravel or sand) to support the weight of a building depends primarily on the strength of the individual soil particles and the friction between them.

presumptive surface bearing values of various soil types, from the 2006 IBC. Classes 3, 4, and 5 refer to the soil group symbols.

Coarse-grained soils consisting of particles of all sizes are termed well graded or poorly sorted, those with a smaller range of particle sizes are termed poorly graded or well sorted, and those with particles mostly of one size are termed uniformly graded.

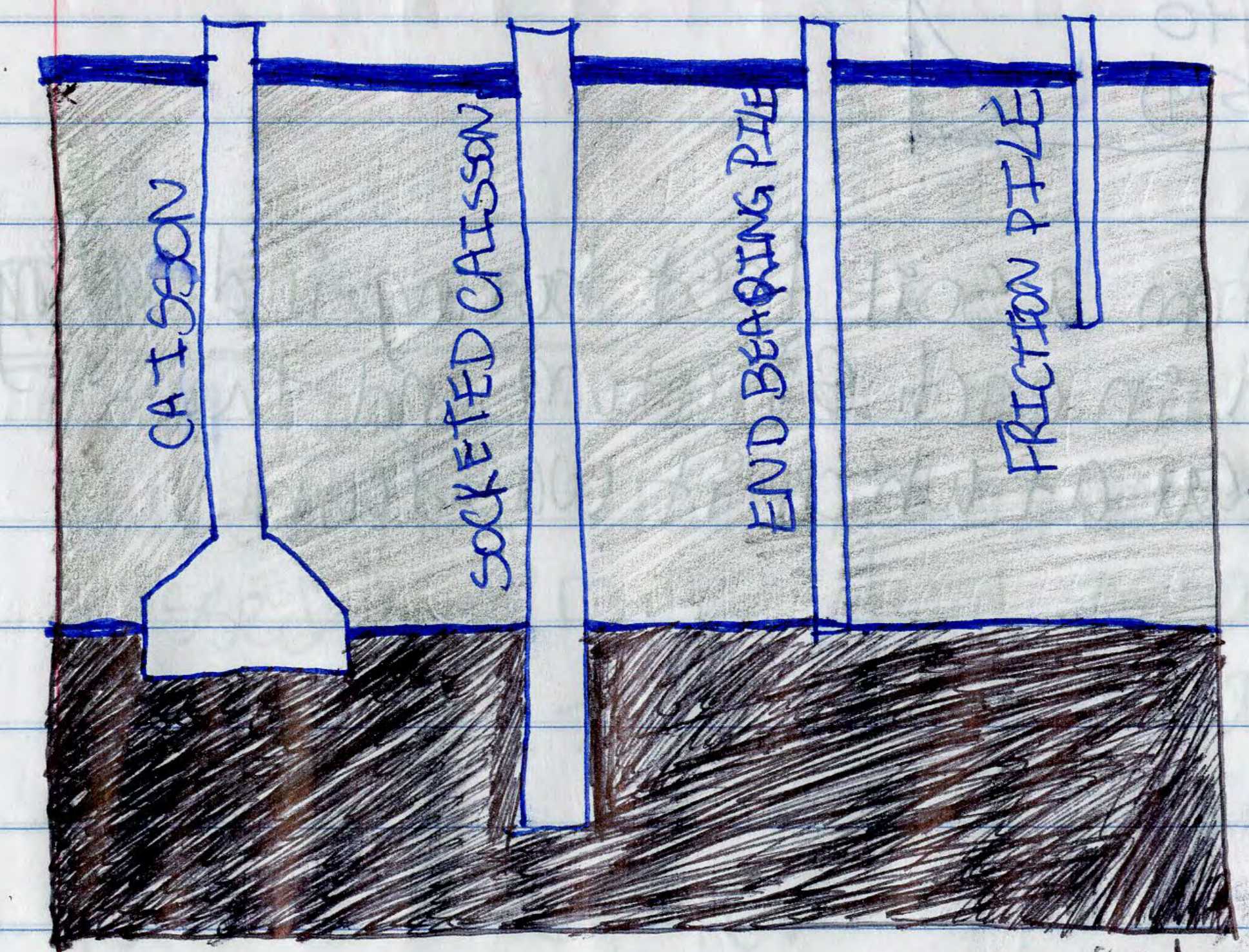
Laboratory testing of soil samples is important for foundation design.

### Excavation

At least some excavation is required for every building.

### Deep foundations (caissons)

A caisson, or drilled pier is similar to a column footing in that it spreads the load from a column over a large enough area of soil that the allowable stress in the soil is not exceeded.



Belled caissons are practical only where the bell can be excavated in a cohesive soil (such as clay) that can retain its shape until concrete is poured.