Waterproofing and Drainage

The materials used to protect foundations from moisture are referred to as either "dampproofing" or "waterproofing". Dampproofing materials are water-resistant, but not adequate for resisting the passage of water under hydstatic pressure. Where drainage conditions are poor, or ground water may be present, materials classified as waterproofing are recommended.

Where waterproofing is required, the choice of system can depend on a variety of factors. Here are a few examples:

a. **Liquid-applied** membranes that cure in place are relatively easy to detail around complex shapes and penetrations, since in liquid state, they can be easily formed to any shape.

b. Sheet membranes that are **loosely laid**, rather than fully adhered, are well-suited for use over substrates prone to movement or cracking, since movement in the substrate is less likely to transmit stress into the membrane.

c. Membranes that are **fully adhered** to the substrate may better limit leakage caused by a minor defects in the membrane, since they are less likely to permit water to travel under the membrane and spread to areas remote from the origin of the leak.

d. Most foundation waterproofing systems must be applied to the exterior side of the foundation wall. **Cementitious** waterproofing, made by the addition of waterproofing agents to portland cement plaster, bonds well enough to concrete to allow its application on the inside of a concrete wall that is exposed to water on its exterior.

e. Many waterproofing systems can only be applied over a dry substrate. **Bentonite clay** is one example of a waterproofing material that can be applied over uncured concrete, potentially an advantage when construction takes place during extended periods of cold and damp.

1. For each condition below, indicate whether dampproofing or waterproofing is most appropriate:

   a. Below-grade space for housing library stacks ____________

   b. Crawlspace in well-drained soil ____________

   c. Below-grade utility room, in normally-drained soil ____________

   d. Finished basement, in normally-drained soil, where owner has expressed particular concerns regarding moisture damage and mold growth ____________

2. For each of the following, propose a waterproofing system and comment briefly on the reason for your choice:

   a. A concrete basement poured in the winter, which is likely to remain damp for many months.

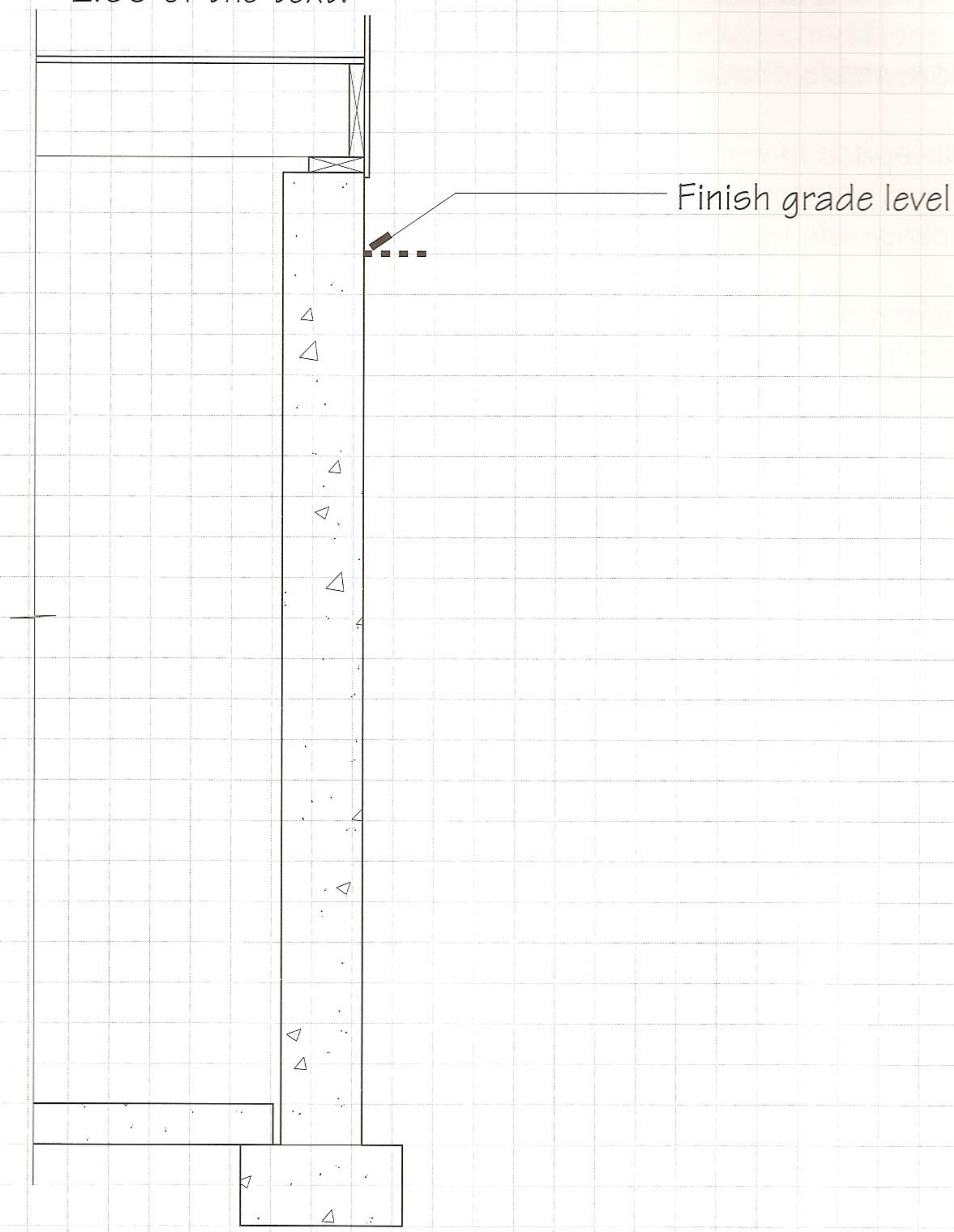
   b. A concrete foundation carrying a prestressed concrete deck. The deck is likely to creep and cause significant cracking in the foundation wall over an extended period.

   c. A concrete elevator pit below grade. The exterior sides of the pit are cast directly against the excavation and will never be accessible for application of waterproofing.

   d. A foundation for an underground mechanical room. The foundation is geometrically complex, and is penetrated in many places to permit the passage of pipes and wiring conduits.

Name: ______________________

3. Complete the following foundation section to include a waterproof membrane on the exterior of the wall, insulation, a drainage system, backfill, and finish grade. Label all features contributing to waterproofing. For guidance, refer to Figures 2.55, 2.57, and 2.60 of the text.



Scale: 3/4" = 1' (1:16)
1 square = 4" (100 mm)

Soil Types and Bearing Capacities 2.2

For assistance with this exercise, refer to Figures 2.2 and 2.5 of the text.

1. Give one or two possible identifications for each of the following. Provide a Group Symbol and descriptive name for each. It is not necessary to distinguish well-graded from poorly-graded soils:

   a. All of the soil particles are visible. Some of the particles are large enough to be picked up individually, but most cannot.

   ____

   b. When dry, the soil seems to be a dusty sand. When wetted it is still gritty like sand, but the soil sticks together in a ball if compressed in the hand.

   ____

   c. No individual soil particles are discernible by eye, but the soil came out of the ground in hard chunks. When a small sample is wetted it becomes a sticky paste that can easily be molded into shapes.

   ____

   d. The smallest particles in the soil can be individually lifted between two fingers, the largest with the whole hand.

   ____

   e. No soil particles are discernible by eye, yet the soil, even when wet, falls apart when an attempt is made to mold it into a shape.

   ____

   f. The soil smells musty and is very dark in color. It seems to spring back slightly after being compressed in the hand.

   ____

2. Which of the above soils is likely to have the highest loadbearing capacity under a wall footing or strip footing?

   ____

3. Which of the above soils would you expect to drain freely?

   ____

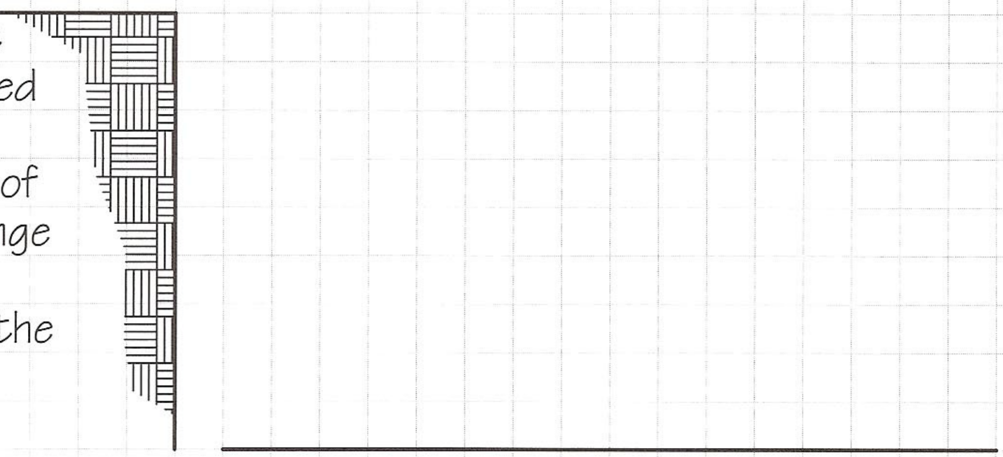
Name: ______________________

4. How large does a square column footing need to be to support a load of 85,000 pounds (39,000 kg) on a compact sandy gravel soil? Show calculations. Make a sketch of the footing, assuming that it is 12" (300 mm) thick.

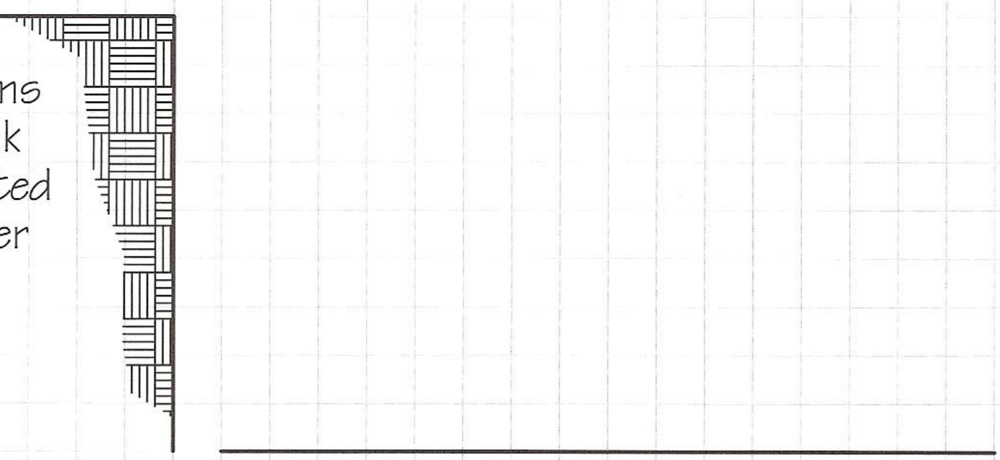
5. How wide must a wall footing be if the load is 3,200 lb (21,000 kg) per foot of wall length, and the footing rests on a sandy clay soil? Show calculations and make a sketch. Assume the footing is 12" (300 mm) thick.

1. Three excavations are shown below in cross section. Draw a slope support system for each as indicated.

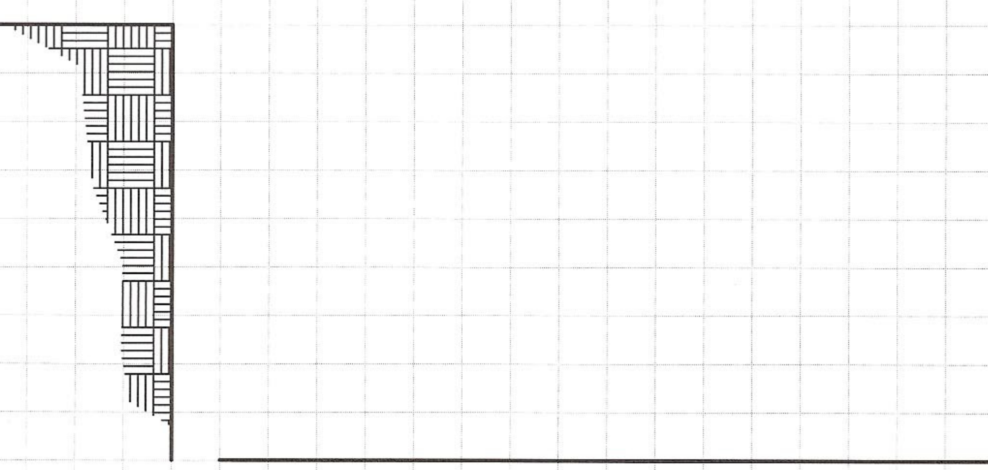
a. Steel sheet piling supported by cross-lot bracing made of steel wide-flange shapes (see Figure 11.10 of the text for illustration of wide flange shapes)



b. Soldier beams and wood plank lagging supported by heavy timber rakers



c. Slurry wall supported by tiebacks



Name: ______________________________ Scale: 1/8" = 1' (1:96)
1 square = 2' (600 mm)