Foundations

What is important to know about foundations?

- You (probably) won't design it
- What are the components that make up a properly designed and built foundation?
- Determine whether house has a good foundation

3 foundation types

- Slab-on-grade
- Crawl space on spread footing
- Basement
  - Concrete
  - Permanent wood foundation

Which foundation is best?

- Topography
- Water table
- Soil type
- Frost depth
- Depth to bedrock
- Personal preference
- Cost

Slab-on-grade

- Not connected to a foundation wall
- Important aspects
  - Foundation wall & slab 8” higher than grade
  - Protect wood in house from water & termites
  - Keeping drainage under slab above surrounding ground
  - Do not place air ducts under slab

Garage slab

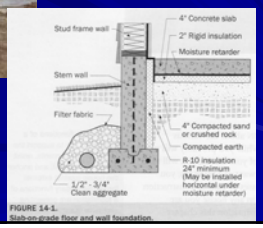


FIGURE 14-1.
Slab-on-grade floor and wall foundation.

Crawl Space

- Non-livable area
- Treat as conditioned or not-conditioned
- 3' higher than interior soil grade
  - Minimum 30" clearance
  - Top of foundation above outside elevation
- Vapor retarder
  - on the soil
- Insulation on walls or in floor

Crawl Space

- Summer hot air enters crawl space. Mixes with cool air in crawl space
- Moisture causes
  - Condensation
  - Free water
  - Mold
  - Wood decay

Crawl Space

- Vented crawl space
- Provides pathway for moist air to exterior of house
- Negative
  - Cold weather – plumbing freeze
  - Increased heat loss thru floors and air ducts

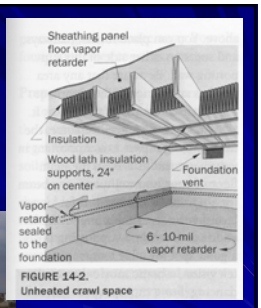


FIGURE 14-2.
Unheated crawl space

Vented Crawl Space

- Insulation – R30 in floor or walls
- Vapor barrier retarder
  - Less than 1.0 perm rating
- Seal openings
- Not pressurized

Vented Crawl Space

- Vent locations
  - High as possible
  - No farther than 3' from corner
  - Unobstructed
  - 1ft^2 for every 500ft^2 of floor area
  - Insect screening
  - Rodent control

FIGURE 14-3.
Crawl space vent grate.

Unvented Crawl Space

- Concrete walls
  - R5 middle US
  - R10 north US
- Pressure treated wood walls
  - R15-R20
- Extruded polystyrene insulation board
- At least 3' in from wall over soil surface w/ vapor retarder, preferable whole surface

Basements

- Good alternative when footings must be several feet deep
- Add 25-50% additional cost but roughly doubles floor space of ground floor

Basements

- 3 basement types
  - Totally underground
  - Walk-out basement
    - 2 or 3 sides below ground
    - Other sides open
    - Usually designed on hillsides
  - Garden-level
    - Only lower half is below ground
    - Good for areas w/ high water table

Basements

- If considered living area, need
  - Heating & AC
  - Insulated walls
  - Designed rooms
    - Bedrooms must have emergency egress
    - Plumbing & electrical needs

Basements

- Support for main floor needed
  - Length wise down center line
  - Use as wall for any rooms, hallway or stairs
  - Must have footings under support

Constructing the foundation

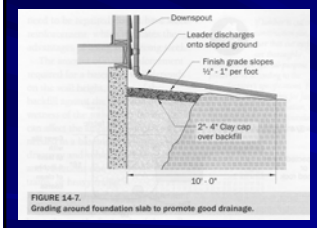


FIGURE 14-7.
Grading around foundation slab to promote good drainage.

- Site prep
  - Removing top soil layer
  - Footing & floor slabs constructed on proper soil
- Proper landscaping
  - Flow water away from house

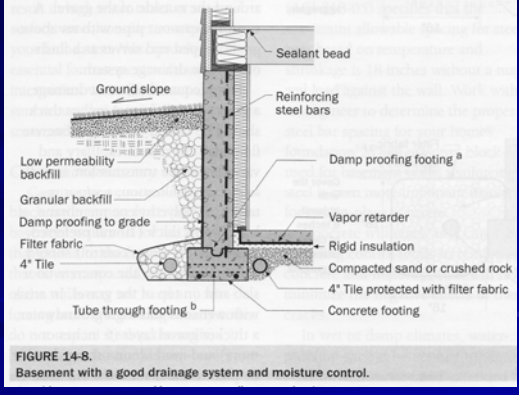


FIGURE 14-8.
Basement with a good drainage system and moisture control.

Constructing the foundation

- Under slabs and footings use coarse sand, gravel or crushed rock
  - Bearing area
  - Drainage of water
  - Radon gas
  - Capillary action

Footing installation

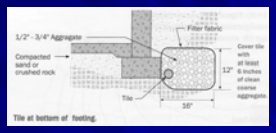
- Used to sustain load from wall, column or post
- Avoid frost heave
  - Below frost depth
  - Insulate if above frost depth

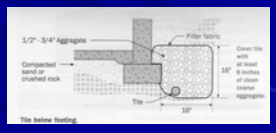
Footing installation

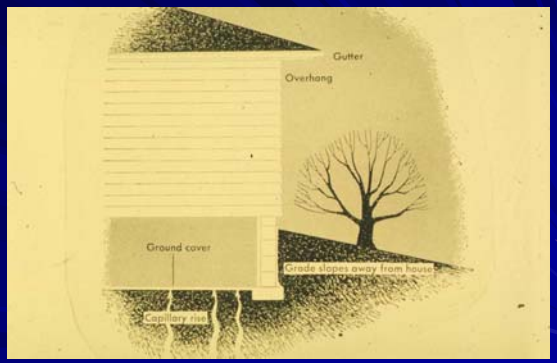
- Frost heaving occurs
  - Freezing temperature
  - Water
  - Frost susceptible soils

Drainage

- Remove water away from foundation
- Eliminate hydrostatic pressure

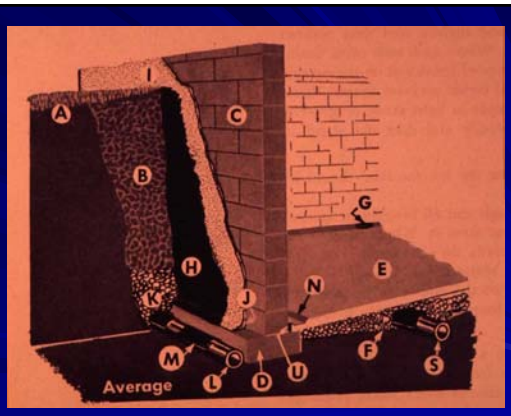






Drainage Systems Components

- Efficient collection of roof rainwater **and** rapid removal from around the foundation
- Slope ground away from house
- Backfill to assist in drainage
- Low permeability substance over backfill
- Drainage around footings
- Seal floor, basement walls, and foundation



Sump pump components

- Tile
- Depth = 30”
- 24” dia or 20” square
- Backup power source
- Automatic turn on and shut off
- Can be inside the foundation footing or outside

Foundation walls

- Cast in place concrete
- Masonry blocks
- Treated wood

Foundation walls

- Reinforced concrete
  - Used to minimize cracks
- Dependent on
  - Wall height
  - Height of backfill
  - Soil type
  - Wetness of soil
  - Traffic
  - Earthquakes

Waterproofing

- Liquid applied membranes
- Plastic & vapor retarder
- Blanket containing bentonite clay
- Drain in floor

Radon, a soil gas

- Odorless, tasteless & invisible
- From decaying uranium in soil
- Causes lung cancer

Radon and soil gases removal

- Sealing cracks
- Radon ventilation system
- Controlling pressures