

# Dream House Foundation

## Level 1 Assignment

### Due Thursday, 11/14 start of class

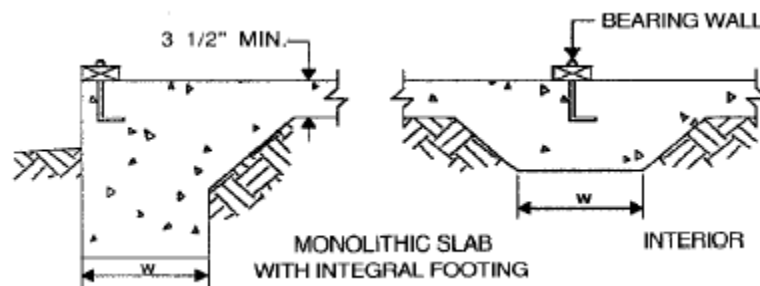
Your Dream House planning is complete except for one small detail: what is it going to rest on? The ground, right? Well, yes, but how? It needs a foundation! There are three basic types of foundations for residential construction:

1. Concrete Slab
2. Crawl Space
3. Full Basement

You may live in a house now that has different types of foundations in different areas. The garage, for example, is usually on a slab. If you have a room converted from an old porch, it is likely over a crawl space. Traditional New England construction often had full basements under the kitchens and bathrooms (and the rooms between them) for ease in repairing plumbing, and slab or crawl spaces under areas with no water or sewer connections. Your assignment is to design and estimate the materials cost for a concrete slab foundation for your Dream House.

Foundation designs must comply with appropriate Building Codes. The Building Code enforced by the United Nations<sup>1</sup> for your international island includes the following provisions:

1. The land surrounding your house must slope away from the house a minimum of 1/2" per foot for a distance of at least six feet from the edge of the house.
2. Sand, silty sand, clayey sand, silty gravel, and clayey gravel can support a load of no more than 3,000 pounds per square foot.
3. The slab must be a minimum of 3 1/2" thick, with additional footing thickness all around the perimeter, beneath all exterior walls. (See drawing below – luckily, your house has no interior bearing walls!)
  - a. Footings must be a minimum of 12" below grade.
  - b. Footing widths (W in the drawing) must be large enough to not exceed the per square foot loading in #2 above.

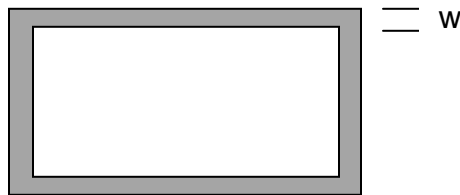


So, all you have to do is:

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<sup>1</sup> Actually, these are from the MA Building Code for Residential Construction, 780 CMR, available at <http://www.mass.gov/bbrs/newcode.htm>

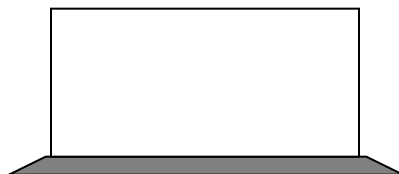
1. Estimate the total weight of the house, including furnishings so that you can do the calculations needed for per square foot loadings. You can use any resources (web or human), but you must explicitly CITE YOUR SOURCES and explain in detail how you arrived at your estimate.
2. Determine the total square footage of the footings necessary to support FIVE TIMES your estimated weight of the house at a maximum of 3000 pounds per square foot.
3. Determine the width ( $W$ ) of your footings. Hint: What is the total perimeter of your house? The slab covers the entire floor area; the footings are a thicker strip all the way around the perimeter:



4. Compute the cubic yards of concrete you will need for the footings and the slab using the footing design above. Hint: compute the slab and the footings separately; and don't worry about the slanty part in the drawing on the front.
5. Of course, you want the best price for your concrete, so you need to request quotes from both Canadian and US firms. So, figure the volume in cubic meters too!

#### EXTRA CREDIT:

As you know, your Dream House is being built on a beach. You can assume that it is far enough back from the shore that the ground is flat. It's very sandy soil, so as long as you meet the grading requirement (#1) above, you don't need to worry about additional drainage. But, you do need to bring in additional sand to raise the foundation of the house enough to account for the drainage slope as show in the following side view sketch (not to scale!):



Determine the total volume of sand you'll need to truck in to raise the foundation and provide around the house to meet the grade requirements. Of course, you'll need this in cubic yards and cubic meters as well.

**Submit your response, including all work for the calculations above, cleanly and readably on a separate sheet(s) of paper.** It doesn't have to be typed, but it must be easy to read, and easy to follow your steps.