FOUNDATIONS IN CONCRETE.

In forming the foundations of a building it is in portant to ascertain the nature of the subsoil and the resistance which 't will offer to the pressure to be put upon it. Where the architect has solid rock to build upon it is only necessary to remove the top soil and level or scarp the surface of the rock before he places his walls upon it. But in the large majority of cases the subsoil is of a yielding nature, so that when it is pressed heavily upon it will sink down and be squeezed out laterally. It then becomes necessary to excavate trenches to some depth in order to get lateral resistance from the surrounding earth and to prevent the sinking down of the foundations. This lateral resistance varies greatly with the character of the soil, and also depends upon the depth of the trenches in which the concrete foundation is laid. It is found that when the soil is dry earth its resistance is nearly eight times as great as when the soil is dry fine sand, and that it is four times as much as when the soil is common sand. We must therefore make superficial areas of our foundations inversely proportional to these amounts; thus the area for common sand must be four times as great as for dry fine sand, and eight times as great as for dry earth.

The lateral resistance of the subsoil is also directly proportional to the depth of the trench, the earth at a depth of 10 ft. offering twice the resistance of that at a depth of 5 ft. where the character of the soil is the same throughout. In the case of dry earth, when the trench is 5 ft. deep, the safe load that we can place upon it is three tons per square foot, but where the soil is wet clay the safe load does not exceed 8 cwt. per square foot.

Suppose, for example, that we have a wall 18 in. thick, the height being 40 ft. and the weight 1 cwt. per cubic foot; then the load will be 60 cwt. for each linear foot of walling, and if we add 10 cwt. for the weight of each foot of roofing and 20 cwt. for two floors, we have a total of 90 cwt. pressing upon each foot length of the trench. Dividing this by three tons, or 60 cwt., in the case of dry earth, we find that 1½ ft. is the least area of foundation required for every foot length of walling, so that no footings are actually necessary, and the concrete need not be wider than the thickness of the wall. Where, however, the soil is wet clay, the least area must be eleven square feet for every linear foot of wall, or the footing must extend 4¾ ft. on each side of the 18 in. wall.

In the above examples the depth of the trench is supposed to be 5 ft., but if the depth is 10 ft., then half the above area of foundations will suffice; so that in the case of wet clay the footings need not extend more than 2½ ft. on each side of the wall.

The object of using concrete in foundations being to distribute the load uniformly over the whole surface of the trench, it is essential that it should have a sufficient thickness to prevent it from cracking across owing to any unevenness in the soil, or from the soil being harder at some points than at others, since the resistance of this material to transverse stress is not great. No concrete foundation should therefore be less than 12 inches in thickness, and in cases of wet clay or loose sand it must be much greater, its resistance to transverse stress increasing as the square of the thickness (or depth), a mass of concrete 2 feet thick offering four times the resistance to this sort of stress that a mass 12 inches thick will offer.

Where the soil is loose and yielding and the building to be erected thereon is very heavy, it is sometimes necessary to use piles before laying the concrete foundations, and to drive them down to a firm bottom. Piles, which are long, square baulks of timber shod with iron, are generally driven until the resistance of the earth amounts to 2,000 lb. or 3,000 lb. per square inch of horizontal section. They are driven into the earth by means of a heavy iron ram, which is let fall from a height upon the head of a pile. The resistance in tons can be calculated by dividing the square of the ram's weight by the ram's weight added to that of the pile itself (all in tons), then multiplying by the height in feet through which the ram fell at its last stroke, and dividing by the distance in fractions of a foot through which the pile sank at that stroke. For example, let the weight of ram be one ton, that of the pile three-quarters of a ton, the height which the ram fell 10 feet, and the amount the pile sank 3-100ths of a foot. Then calculating by the above rule, we find the resistance of the earth to amount to 190 tons; and if the pile is 12 inches square the resistance will be 3,000 lb. per square inch, and one-fifth of this, or 600 lb., may be taken as the utmost load per square inch that can with safety be placed upon it, provided the pile has reached a firm bottom. If, however, the pile has failed to do so, the safe load will not be more than half the above, or 300 lb. per square inch.

A ram weighing one ton and falling 10 feet produces a pressure equivalent to twenty-five tons on the head of the pile; if it fell 20 feet the pressure on the pile would be thirty-six tons, the pressure being proportional to the square root of the height.—Illustrated Carpenter and Builder

MAKING CEMENT WALLS BY "POURING" THE MATERIAL.

Some time ago an article appeared in one of the well known periodicals by Thomas A. Edison in which he suggested the building of houses and other structures by "pouring" the material, and in order to demonstrate the practicability of this form of construction John R. Pisel, of Akron, Ohio, has lately built the basement walls of several of his houses by this method. In executing the work Mr. Pisel states that he used planks 16 feet long, 2 inches thick and 12 inches wide, two planks being bolted with three iron bolts, so that the space between the planks was 12 inches, this, of course, giving a 12-inch wall. The planks were laid lengthwise on the ground where the wall was built, and the space was filled in between them with a mixture of 1 part cement and 3 parts coarse sand or pebbles. This mixture was "poured" in slush form and then boulders, or, as they are termed in that locality, "nigger heads," were dropped in. When the space was filled more plank was put on and the lower set removed, this operation being continued until the proper height was reached. Wooden pins were used through the wall at points where it was desired to put in pipes for water, gas or sewer, as after the mixture had set it was almost impossible to penetrate it.

Mr. Pisel states that the running length of the walls was 110 feet, and that the cost of this process was only a little more than half what a brick contractor demanded for building an 8-inch wall.