Ken Kern notes on plunger pile floor system

From the "Owner Built Home", p. 282

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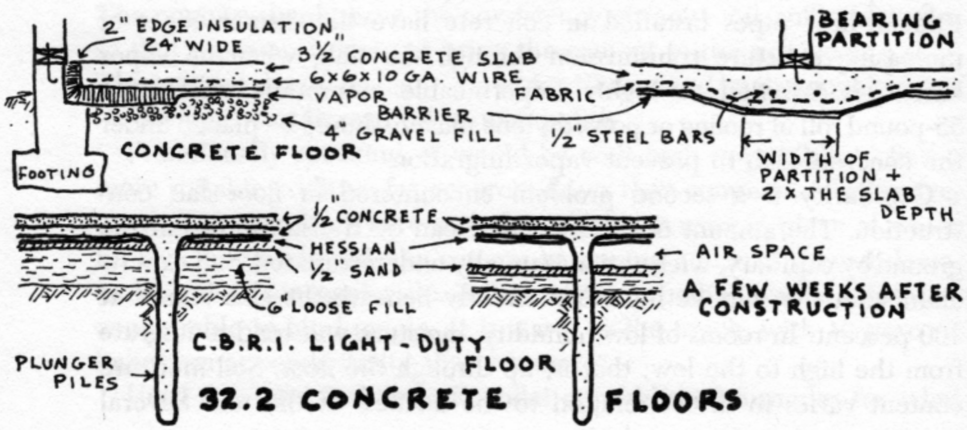
inches of coarse, washed gravel will adequately interrupt capillarity. Gravel beneath the slab also serves as a thermal break between slab and ground. Since heat absorbed from the room is not dissipated as rapidly to the ground, winter comfort is increased. Heat is transmitted about four times as fast through damp silt or clay soil as through dry gravel.

Interesting variations of the gravel-filled slab base have been made by builders in Southern Rhodesia and South Africa. They use the no-fines concrete mixture mentioned in chapter twenty-two. A 3-inch layer of 8 parts crushed stone to 1 part cement is spread over a tamped earth filling. This no-fines surface bed is immediately covered with a $\frac{3}{4}$-inch cement screed, merely for a smooth finish. Thermal-insulation properties are said to be better with this mix than that made with dense concrete, and capillarity is reduced. There is cost economy, moreover, in this method, since less cement, as well as no sand, is used in the mixture.

Ideally, the best guarantee against capillarity is a continuous air space between floor and ground. A low-cost floor of this nature was developed a few years ago by Dr. Billig of the Central Building Research Institute in India. Although described as a light-duty floor, it was subjected to loading stresses of up to 450 pounds per square foot, without showing any sign of distress. (Most building codes in America require a 30 to 50 pound per square foot minimum. In conservative, residential occupancy the furniture loads seldom exceed 15 pounds per square foot, uniformly distributed.) The C.B.R.I. floor



32.2 CONCRETE FLOORS

consists of a 1-inch-thick, lightly reinforced concrete slab resting on plunger piles. To make a hole for a pile, a crowbar is driven into the ground to a depth of 3 feet. The hole thus made is filled with fine concrete. The piles are spaced on 3-foot centers. The slab consists of two layers of concrete, each $\frac{1}{4}$ inch thick, spread over hessian, a form of burlap. After a few weeks, the loose earth filling under the slab settles, and an air space is formed under the slab, which finally rests on the concrete piles. Effective heat insulation results, with the floor being cool in the summer and warm in the winter. The dead weight of the floor is on the order of one-fourth that of a conventional, concrete floor. Where a no-draft, under-floor air-circulation pattern is planned, as illustrated in the hypothetical house design, Figure 2.1, an owner-builder could do no better than to install a plunger-pile floor. An English variation of this flooring system specifies the use of a rototiller to loosen the earth before pouring concrete. Supposedly, soil stirred in this manner compacts more after the slab has settled and will provide a larger air-space cavity.

Given a well-drained building site, an elevated, air-spaced, or gravel-filled subfloor, and a continuous, impermeable moisture barrier, there is no functional reason why a concrete floor cannot be adequately resilient, warm, and dry.

The author has found that good quality concrete, relatively impermeable to moisture migration, can be produced even without a moisture barrier. First, the mixture proportion must be correct. Shrinking and cracking are caused almost entirely by too much water in the mixture. With a 5-sack mix (5 cubic feet of cement for each cubic yard of concrete), no more than 6 gallons of water should be used. A good proportion is 1 part cement, $2\frac{1}{4}$ parts sand, and 3 parts rock.

Immediately after the slab is poured, the concrete should be thoroughly consolidated by vibration, spading, or tamping. It can then be screeded to proper grade. The screeding operation is immediately followed by floating or darbying, which is done with a specially constructed, long wooden trowel. The long darby is used to embed coarse aggregate in preparation for hand floating and troweling. It helps to level the surface and provides further compaction. Final troweling is done only after the concrete has hardened sufficiently so that moisture and fine particles do not rise to the surface. A wooden trowel is first used, followed by a steel trowel when the concrete is